

CONDENSED  
CATALOGUES  
OF  
MECHANICAL  
EQUIPMENT

WITH  
GENERAL CLASSIFIED DIRECTORY  
AND  
ENGINEERING DATA SECTION

NINTH ANNUAL VOLUME

1919

THE AMERICAN SOCIETY *of*  
MECHANICAL ENGINEERS

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# **CONDENSED CATALOGUES OF MECHANICAL EQUIPMENT**

**WITH**

**MECHANICAL EQUIPMENT DIRECTORY  
and  
CONSULTING ENGINEERS' DIRECTORY**

**Standardization Work of the Society,  
and Engineering Data are included**

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## PREFACE

**T**HE striking increase in the size and comprehensiveness of this, the Ninth Annual (1919) Volume of A. S. M. E. Condensed Catalogues of Mechanical Equipment will be immediately apparent and it is with special pleasure that the Society places the volume at the service of the membership and of the mechanical engineering profession at large.

Five hundred and nine firms are represented by publication of catalogue data in this edition, constituting a gain of nearly one hundred firms as compared with the 1918 volume; and it is worthy of remark that among them are a large proportion of the leading manufacturers in their respective lines. At the same time the number of catalogue pages has been greatly increased, as shown by the fact that there are six hundred and sixty-nine pages in the Catalogue Section as against five hundred and fifteen in 1918, a gain of thirty per cent.

The general Mechanical Equipment Directory, in which all eligible manufacturers are entitled to listing of their products free of charge within reasonable limits, and the Consulting Engineers' Directory compiled from the membership of the Society, have also been extended and improved, and it is believed that these reference features will prove of even greater value than heretofore. Attention is also called to the enlargement of the Data Section with its addition of a concise list of current A. S. M. E. Standards and the greatly increased amount of engineering data presented.

The requirements of the engineer for detailed information and specific data in a reference work of this character have been realized by the manufacturers in presenting their material, and it is believed that the new double column arrangement of text matter without border rules has been helpful in this respect. It is confidently expected that future editions will show constant progress along these lines, to the end that the engineer will more than ever rely upon the Condensed Catalogues as a primary source of reference concerning the products of the various manufacturers in the field.

The publication of the annual volume A. S. M. E. Condensed Catalogues of Mechanical Equipment is essentially a coöperative undertaking in which the Society acts as a logical agent rather than as a publisher in the usual sense of the term. The Society takes this opportunity to express its thanks to the many firms whose coöperation in the use of space has made it possible to furnish this useful reference work to the mechanical engineering profession, with the aim of affording a closer and more efficient point of contact between the user and the maker of mechanical equipment.



**NOTE.**—All data presented have been edited with a view to the elimination of advertising claims or exaggerated statements and every effort made to restrict the Condensed Catalogues to firms of good standing only. Publication of catalogue data does not constitute in any sense an endorsement by the Society of the firms or products thus represented.

*Extract from Constitution: C 55. The Society shall not be responsible for statements or opinions advanced in papers or in discussions.*





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**CATALOGUE SECTION  
PART I**

**Power Plant Equipment**

1

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## AMES IRON WORKS

OSWEGO, N. Y.

Branches in All Principal Cities

Builders of Steam Boilers, Engines, Tanks and General Plate Work

### STEAM BOILERS:

Ames Steam Boilers are built in such a variety of styles and sizes that their range of application is practically unlimited where Steam Boilers are required.

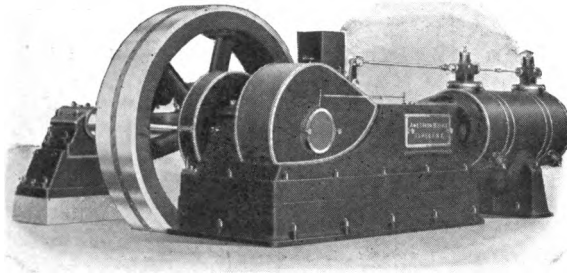
The Fire Tube type is built in Vertical (full length and submerged tubes), Horizontal Tubular for brick setting, Portable, Locomotive, Firebox and the Empire Return Tubular for either portable or stationary setting.

Ames Horizontal Water Tube Boilers are built in sizes from 100 to 500 H. P. for medium and high pressures of the present-day practice. The general design and construction is of the highest type and coupled with our experience of boiler

with either throttling or automatic governor for belt drive to all kinds of equipment where a dependable steam engine is required in sizes from 10 to 400 H. P.

Heavy Duty Single Valve Side and Center Crank in sizes from 25 to 500 H. P. for medium and high speed operation of direct connected electric generators and other heavy power service for belt drive.

Non-Releasing Corliss Four Valve for heavy duty service and medium speed operation of electric generators and general power plant work for non-condensing operation where high economy is essential, and is built in sizes from 150 to 500 H. P.



Ames Una-Flow Engine

building for the past sixty years and highest grade workmanship places it in a class by itself.

### TANKS:

Storage, Blow-off and general purpose Tanks are built in all sizes and types for every requirement.

### STACKS:

Self-supporting and guyed Stacks and Smoke Connections are a specialty and built to specification throughout to suit local conditions as circumstances require.

### STEAM ENGINES:

Ames Engines, as in the past, are the acknowledged standard for the purpose they are intended, depending on requirements. They are built of various types in sizes from 10 to 1000 H. P.

The various types comprise medium speed Side and Center Crank equipped

### UNA-FLOW ENGINES:

The Ames Una-Flow Engine is without a doubt the last word in the art of design, construction and product for a steam power plant.

They are built in sizes from 50 to 1000 H. P. for either condensing or non-condensing operation and maximum economy in the use of steam is the result. Poppet valves are employed throughout in all sizes. The Engines are of the heavy duty side crank construction for the most satisfactory service for every power plant requirement.

May we advise you why the Una-Flow Engine is the most efficient prime mover yet developed? Our Engineering Department is at your service and will gladly consult with you.

*Bulletin illustrating and describing any of the above will be furnished on request.*

*Hydraulic and Steam Turbines, Centrifugal Pumps*

## **ALLIS-CHALMERS MFG. CO.**

**MILWAUKEE, WIS.**

Sales Offices in All Principal Cities

**FOREIGN OFFICE:** Paris

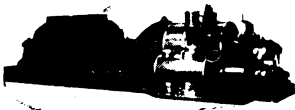
**NEW ORLEANS OFFICE:** Maison Blanche Bldg.

**NEW YORK OFFICE:** 50 Church Street



**Five 500 K. V. A. Vertical Hydro-Electric Turbines**

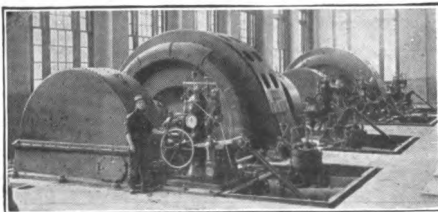
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**Standard 4000 K. W. Steam Turbine and  
Alternator Unit**



**Type "S" Centrifugal Pump Connected to Type  
"A N" Motor**



**Allis-Chalmers Impulse Wheels: 46,000 H. P.  
Concentrated in Two Units, 2160  
Foot Head, 375 R. P. M.**



**COMPLETE LINE OF  
ELECTRICAL MACHINERY**

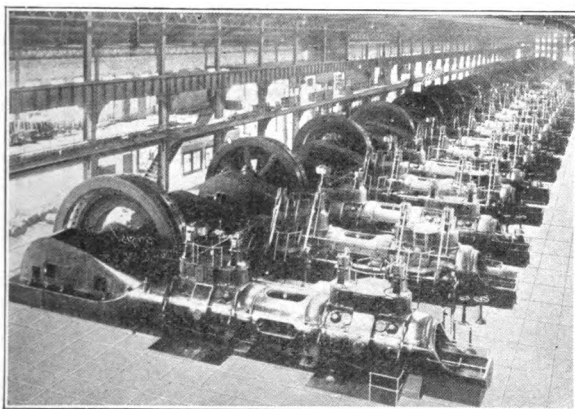
**STEAM TURBINES  
HYDRAULIC TURBINES  
CENTRIFUGAL PUMPS  
PUMPING ENGINES**

**FLOUR MILL MACHINERY  
SAW MILL MACHINERY  
TRANSMISSION MACHINERY  
PULLEYS, SHAFTING, ETC.**

**FARM TRACTORS**

*Steam Engines, Compressors, Gas Engines, Mining Machinery*

## ALLIS-CHALMERS MFG. CO.



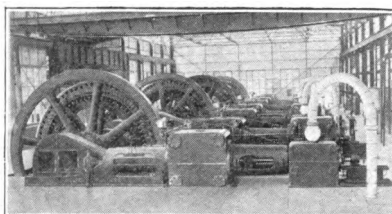
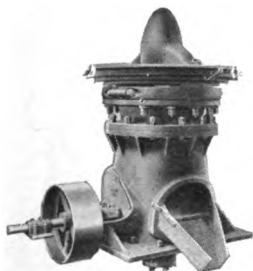
Power House, Illinois Steel Company, Gary, Indiana



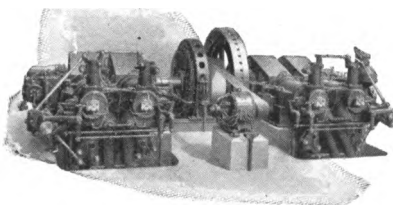
**STEAM ENGINES, CORLISS TYPE  
BLOWING ENGINES  
OIL ENGINES, DIESEL TYPE  
GAS ENGINES  
AIR COMPRESSORS  
CONDENSERS**

**MINING & CONCENTRATING MACH'Y  
CRUSHING & CEMENT MACH'Y**

**Style "K"  
Gates Rock  
and  
Ore Breaker**

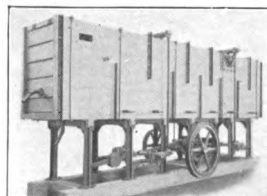


**our Allis-Chalmers 2200 K. V. A. Alternator  
connected to Allis-Chalmers Engines**



**Allis-Chalmers Twin Duplex Oil Engine  
Direct connected to 60-Cycle  
Allis-Chalmers Engine Type Alternator**

**Hancock  
Jig**

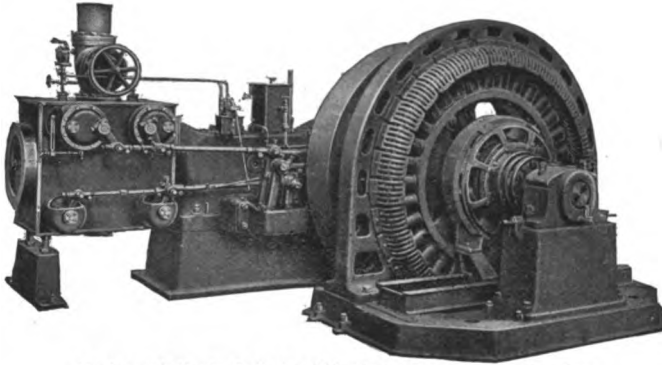


## BALL ENGINE CO.

ERIE, PENNSYLVANIA

**Builders of Corliss-Valve and Single-Valve Engines; Horizontal and Vertical Side-Crank Engines; Tandem- and Cross-Compound Single-Valve Engines, Corliss-Valve Compound and Single-Cylinder Engines**

---



Horizontal Single-Cylinder Side-Crank Engine—Corliss Type

### **BALL HIGH-SPEED CORLISS ENGINES:**

The feature which distinguishes this engine from other four-valve shaft-governed engines is the patented non-detaching valve gear, which imparts the same movement to the valves that the drop cut-off of the slow-speed Corliss produces by picking up and dropping them. This permits the use of the best form of valve, and the valves are given the movement necessary for the greatest durability and tightness.

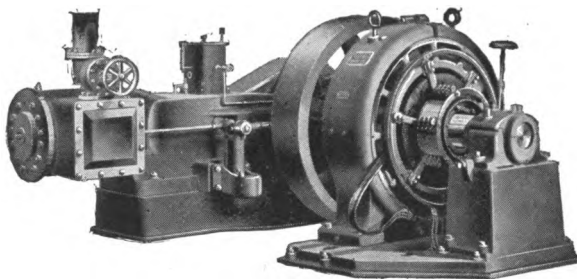
Built in sizes from 100 H. P. to 1600 H. P. in the single-cylinder and cross-compound types.

These engines excel in economy and regulation and are especially adapted for electric service.

### **BALL SINGLE-VALVE AUTOMATIC ENGINES:**

These engines are the result of a long experience in building engines for electric service. They are superior in design and construction. The regulation and economy are the best of their type.

Built in sizes from 25 H. P. to 800 H. P. in the single-cylinder tandem-compound and cross-compound types.



Single-Cylinder Side-Crank Engine—Single-Valve Type



## NORDBERG MFG. CO.

MILWAUKEE, WIS.

**Engineers and Designers of High Efficiency Poppet Valve Engines, Poppet Uniflow Engines, Corliss Engines, High Compression Oil Engines, Nordberg-Carels Diesel Type Engines, Air Compressors, Blowing Engines, Steam, Air and Electric Hoists.**

### POPPET VALVE UNIFLOW ENGINES:

These engines have Poppet valves and exhaust through ports in the cylinder wall uncovered by the piston. A Uniflow Engine operating on a widely fluctuating load gives a lower average steam consumption than any other type of steam engine.

### CORLISS ENGINES:

Nordberg Corliss Engines are built in all sizes with both the standard and Long Range valve gear.

### HIGH COMPRESSION TWO-CYCLE OIL ENGINES:

This is the simplest oil engine on the market today. There are no valve gears or valves subject to the working pressure and heat. The only valve is a low pressure piston valve for scavenging air. These engines are built in sizes from 50 to 550 B. H. P.

### NORDBERG-CARELS DIESEL TYPE ENGINES:

In large sizes up to and including 1,500 hp., the Nordberg Company builds Diesel Engines under patents of Carels Frères, who have built more large Diesel Engines than any other company in the world.

### ELECTRIC HOISTS:

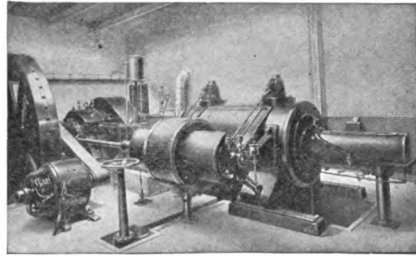
Nordberg Electric Hoists are built in sizes having drums from four feet in diameter up to the largest now operating in this country.

### STEAM AND AIR HOISTS:

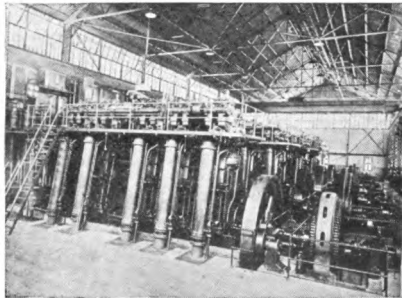
Nordberg Steam Hoists are well known to all mining men. Practically all of the large hoists for high speeds and great depths have been built by the Nordberg Co.

All of the successful compound condensing steam hoists and all the Air Hoists are of Nordberg make.

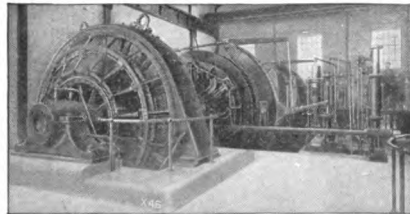
*Bulletin sent upon request.*



Nordberg Poppet Valve Uniflow Engine as recommended for steam plant installations. The valve gear opens and closes the valves positively without the use of spring or dash pot and all valves seat in removable cages, which are fitted in the heads.



Nordberg-Carels Diesel Type Oil Engines. Consists of four 5 cyl. Nordberg-Carels Diesel Type Oil Engines direct connected to generator, and one 3 cyl. engine direct connected to a 4,000 cu. ft. air compressor. This installation is at the Burro Mountain Copper Co. at Tyrone, New Mexico.



Nordberg First Motion electric driven hoist for the Elm Orlu Mining Co., Butte, Mont.; load 32,000 lb.; depth 3,500 ft.; hoisting speed 2,500 ft. per minute.

*Dynamos, Engines*

## ENGBERG'S ELECTRIC & MECHANICAL WORKS

NO. 18 VINE ST., ST. JOSEPH, MICHIGAN, U. S. A.

**Manufacturers of Dynamos and Engines**

### ENGBERG ENGINES AND GENERATORS:

Are pre-eminent. They are positively a model of perfection—an ideal formulated after twenty years' experience—in designing, building and testing Engines and Generators. For dependability, economy in steam and oil and low cost of maintenance, ENGBERG Direct Connected Generating Sets are a most remarkable piece of equipment.

8 We have produced the very best and the record of our machines and the growth of our business verify this statement. It proves we have been most successful in the undertaking. It shows the design has been very carefully worked out on scientific and modern engineering principles, and, furthermore, that the workmanship and materials cannot be excelled.

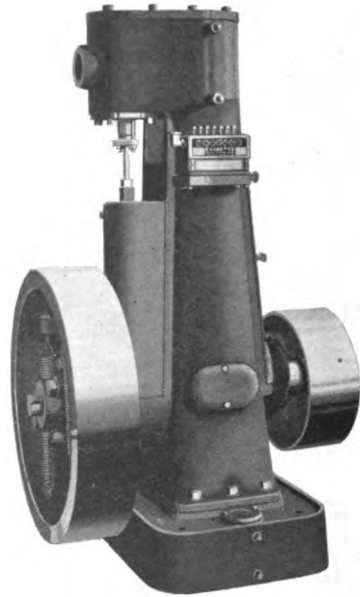
### ENGBERG DIRECT CONNECTED GENERATING SETS:

Have been adopted as a standard by the most responsible concerns, because they give every service that any reasonable operator could expect. They are built up to an ideal—not down to price. The design has been formulated, not by one individual, but upon the advice and the co-operation of thousands of users.

Every detail has become a standard through public approval and has demon-

strated its supreme excellence by continuous, efficient and satisfactory performance.

There is no doubt but what ENGBERG apparatus has more predominant, distinctive and serviceable features than any other similar equipment on the market—barring none and regardless of price.



**Vertical, Self-Oiling Engines 1 to 125 H. P.**

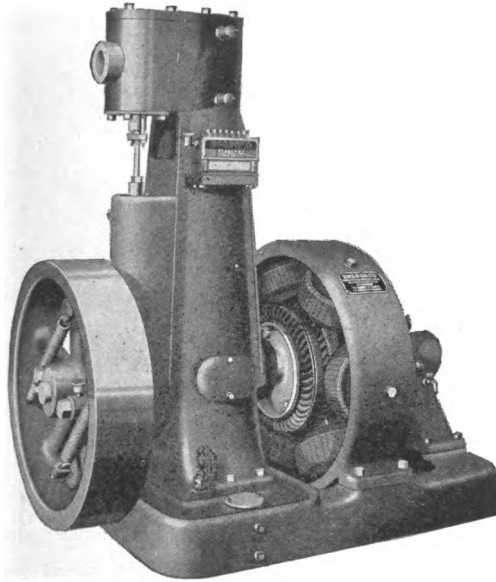
We invite careful inspection and investigation, because the general principles, as well as the smallest details, have never failed to attract the attention of the most critical buyer.

For Economy, Durability and Successful Operation they are most acceptable.

# ENGBERG'S ELECTRIC & MECHANICAL WORKS

No. 18 VINE ST., ST. JOSEPH, MICHIGAN, U. S. A.

Manufacturers of Dynamos and Engines



Direct Connected Generating Sets 1 to 50 K. W.

## SPECIFICATIONS AND DATA

Engine Frame	K. W.	No. of Poles	Size of Engine	Steam Pressure	Rev. per Minute	Diameter Pipes		Code Word 110-125 Volts	Code Word 220-230 Volts
						Steam	Exhaust		
A	1	4	3½x3½	90	750	1	1¼	Bacaad	Olgaad
A	1½	4	3½x3½	90	750	1	1¼	Edcaad	Rogaad
A	2½	4	3½x3½	90	750	1	1¼	Fecaad	Spgaad
B	3½	4	4½x4	90	500	1¼	1½	Itcaad	Urgaad
B	5	4	4½x4	90	700	1¼	1½	Jicaad	Wtgaad
B	6	4	6x5	90	400	1½	2	Lkcaad	Xugaad
C	7½	4	6x5	90	500	1½	2	Oucaad	Yvgaad
D	8	6	6x6	90	375	2	2½	Pacaad	Axgaad
D	10	6	6x6	90	450	2	2½	Srcaad	Bygaad
D	10	6	7x6	90	350	2	2½	Tscaad	Fakaad
D	12½	6	7x6	90	425	2	2½	Utcaad	Hckaad
F	15	6	7x7	90	400	2½	3	Vucaad	Idkaad
F	17½	6	8x7	90	400	2½	3	Yxcaad	Jekaad
G	20	6	8x8	90	325	3	3½	Azcaad	Lkgaad
G	25	6	8x8	90	400	3	3½	Dagaad	Nikaad
I	25	8	9x9	90	325	3	3½	Ebgaad	Ojkaad
I	30	8	10x9	90	300	3	3½	Higaad	Sukaad
J	40	8	10x10	90	300	3	3½	Ifgaad	Upkaad
J	50	8	12x10	90	275	3	3½	Ligaad	Ytpaad

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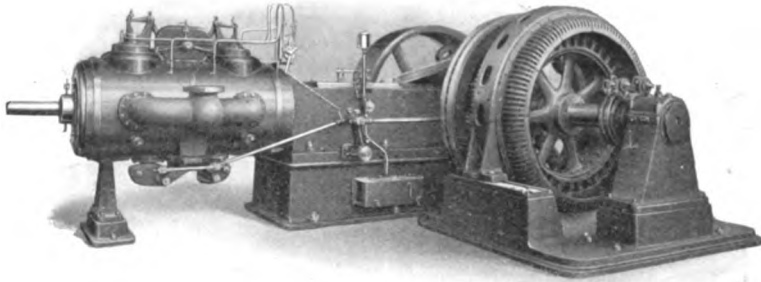
## SKINNER ENGINE COMPANY

ERIE, PA., U. S. A.

Branches in 32 Cities

Builders of High Grade Automatic Engines

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10

### THE "UNIVERSAL UNAFLOW:"

THE MOST ECONOMICAL STEAM  
ENGINE EVER BUILT.



Any engine will *operate* noncondensing and condensing; but the "UNIVERSAL UNAFLOW" is the only engine that will give *maximum economy* under both conditions, because it is

### THE ONLY UNAFLOW ENGINE:

—That operates noncondensing, as well as condensing, with *small clearances*.

—That automatically changes, while in operation, from a condensing to a non-condensing engine, and *vice versa*, with changes of exhaust pressure, giving the maximum economy under both conditions.

—That has expanding poppet valves which remain STEAM-TIGHT under all temperature and pressure changes.

This engine has demonstrated its economy over other makes of engines, and against outside current, in hundreds of power plants.

Built only  
Because Patented } by Skinner Engine Co.

*Write for bulletin.*

# TROY ENGINE & MACHINE CO.

TROY, PENNSYLVANIA

Manufacturers of Center-Crank Steam Engines



## TROY ENGINES:

Back of the Troy engine stand 28 years of specialized effort to produce the best engine selected materials, skilled workmen and engineering experts are capable of. We are therefore justly proud of the world-wide reputation for excellent efficient service which the Troy engines have gained.

Troy engines are especially adapted for and give excellent service in driving:

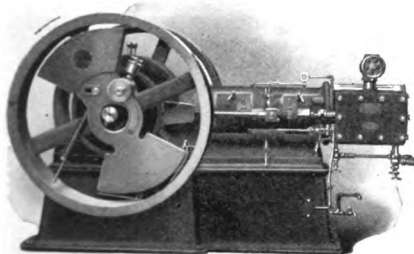
Stokers	Generators
Fans	Compressors
Positive Pressure	Dryers
Blowers	Scrubbers
Centrifugal Pumps	Auxiliary Equipment
Rotary Pumps	in large plants

The standard Troy Engines are listed below. Column P gives the maximum usual pressure and Column S the number of sizes made.

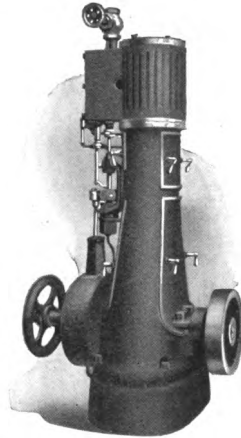
Troy Engines	P	S
Vertical Automatic.....	80-160	13
Horizontal Automatic.....	80-160	8
Vertical Direct-Connected.....	80-160	13
Horizontal Direct-Connected...	80-160	8
Vertical Throttling.....	80-160	14
Horizontal Throttling.....	80-160	9
Vertical Low-Pressure.....	10- 40	10
Horizontal Low-Pressure.....	10- 40	6

All the above are made either enclosed and self-oiling, or open with gravity lubrication.

Sizes—2 to 100 H. P.



Horizontal Automatic Type for Belted Service



Special Type of Vertical Throttling for D. C. to Fan or Blower

All Troy Engines are built in the center-crank type and of compact and symmetrical design. The cylinder frame and base are independent parts, machine fitted and interchangeable.

The Base is of a heavy substantial pattern, enclosed for the collection of oil and water.

The Frame is of heavy construction and forms the main bearings. These are lined with the best genuine babbitt metal.

The Cylinder and Steam-Chest are one casting built generously to stand a stipulated steam pressure.

The Valves are of the balanced type—always steam-tight.

The Piston is a single casting; cored center to lighten. Grooved and provided with removable packing rings to make piston steam-tight.

The Crosshead is adjustable to take up wear and is provided with thorough lubricating passages.

The Crankshaft and Connecting Rod are steel forgings. The Connecting Rod is extra long to minimize friction, save power and lengthen life of bearings.

The Self-Oiling System (patented) thoroughly lubricates, saves oil and operates automatically. The bearings run in oil, minimizing wear, and the cost of lubrication is less. The oil pump and the check valve are designed especially for this service.

There are three types of engines made: Low Pressure for steam from 10 to 35 lbs., Standard for steam at from 60 to 160 lbs. and Special engines to take care of pressures exceeding 160 lbs. and to operate on superheated steam.

Each order receives personal attention so as to adapt the engine in the nicest possible manner for the service it has to perform. Blue prints giving general dimensions can be furnished to permit you to run lines, make foundation, etc.

Catalogs mailed you upon request. Our engineering staff is also at your service in aiding you to select the proper equipment.

## THE VILTER MANUFACTURING CO.

1194-1196 CLINTON ST., MILWAUKEE, WISCONSIN, U. S. A.

**Builders of Ice Making and Refrigerating Machinery, Corliss Engines, Poppet Valve Engines, Ammonia Valves and Fittings, Ammonia Condensers, Special Machinery, Etc.**

### BRANCH OFFICES

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NEW YORK, N. Y.  
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2650 Santa Fe Ave.  
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KANSAS CITY, MO.  
731 Monadnock Bldg.  
CHICAGO, ILL.  
314 Curry Bldg.  
PITTSBURGH, PA.  
Wellington  
NEW ZEALAND

2723 Bennett Court  
ST. LOUIS, MO.  
28 West Broadway  
SALT LAKE CITY, UTAH  
519 Beatty Bldg.  
HOUSTON, TEXAS  
O'Reilly 9  
HAVANA, CUBA

### VILTER TANDEM COMPOUND POPPET VALVE ENGINE:

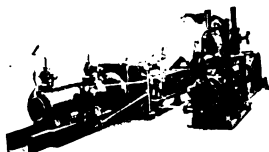


Fig. 1

- 12 **Fig. 1.** Vilter Tandem Compound Engine shown with poppet high pressure and Corliss low pressure cylinder direct connected to Rolling Mill type compressor. The most economical combination known using high pressure superheated steam. A leading feature is the valve gear operated through wrist plates driven from eccentrics.

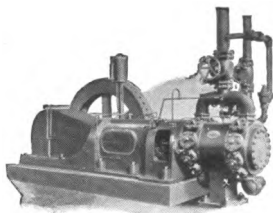


Fig. 2

**Fig. 2.** Vilter horizontal high speed ammonia compressors are simple in design, rugged in appearance, and in the

character of service they give. They are specially designed for direct connection to the newest types of high-speed prime movers, and particularly adapted for direct connection to synchronous motors, a method of drive which is proving so highly economical and efficient.

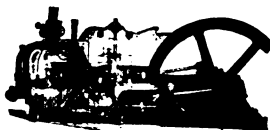


Fig. 3

**Fig. 3.** The Rolling Mill frame Ammonia Compressor is built along very heavy lines for all conditions of service. It is used with only slight modifications in all sizes of compressors. Its very appearance gives assurance and proof of its strength and reliability. All parts of the base rest upon the foundation, thus giving uniform distribution of the load and insuring maximum stability and rigidity.



Fig. 4

## THE VILTER MANUFACTURING CO.

**Fig. 4.** The Rolling Mill type Corliss Engine is of massive construction throughout, the pillow block and guide being made in one casting, securing great strength and rigidity. It is adapted to any class of service from a steady belted load to direct connected electrical service.

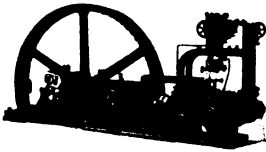


Fig 5

**Fig. 5.** The belt-driven machines are furnished in either single or duplex units. These units may be driven by electric motor, gas or oil engines, etc. Single units built in sizes from 6 to 375 tons daily refrigerating capacity, duplex units in sizes from 12 to 750 tons daily refrigerating capacity.

### SMALL VERTICAL TWIN CYLINDER AMMONIA COMPRESSORS:

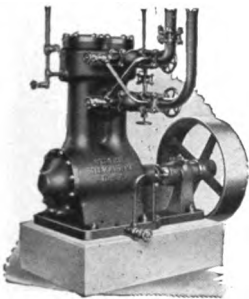


Fig. 6

**Fig. 6.** A small, single-acting compressor, especially designed for users of comparatively small quantities of refrigeration. It is reasonable in first cost. Economical to operate. Simple in construction. Needs very little attention. Is always ready for service. Built in sizes from 1 ton to 20 tons daily refrigerating capacity.

### VILTER LOW TEMPERATURE COMPRESSION SYSTEM:

A system manufactured under D. I. Davis patents whereby extremely low temperatures are efficiently and economically produced with compression refrigerating machinery. The simple ammonia compression machine has been conceded as both expensive and uneconomical for low temperature work. These detrimental features are overcome by the Low Temperature Compression System by the following methods:

(1) Multistage compression, which increases volumetric efficiency and reduces the power required for operating the compressors.

(2) Cooling the liquid before entering the low temperature refrigerator, thus reducing amount of gas handled by low pressure compressor and power per ton of refrigeration—because the work of cooling is handled by the high pressure cylinder.

(3) Intermediate Gas Cooling.

(4) Proper traps, etc.

### LITERATURE:

Bulletins, catalogues and full data regarding our products mailed on request.



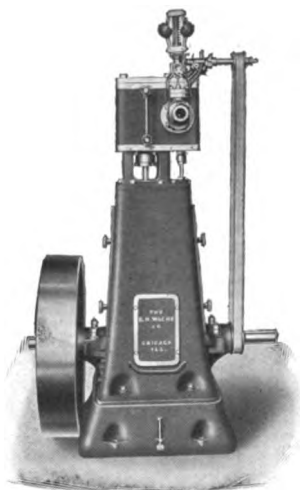
# THE E. H. WACHS COMPANY

1525 DAYTON ST., CHICAGO, ILL., U. S. A.

Manufacturers of Vertical Steam Engines

## FULLY ENCLOSED AND SELF-OILING:

Sizes—4" x 5" to 11" x 10".

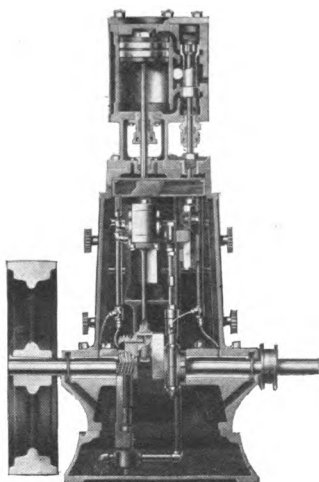


14

This engine is of exceptionally heavy design and liberal proportions. The fully enclosed feature makes it dust and oil proof.

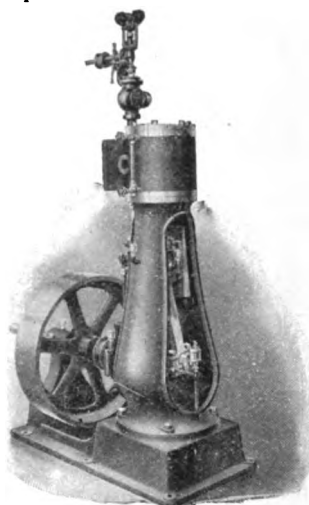
The oiling system is of the gravity type supplied by an oversize pump in base, thus assuring abundant lubrication.

Built for severe service with minimum attention.



## STANDARD OPEN-TYPE ENGINES:

Oil cup lubrication.



Side Crank

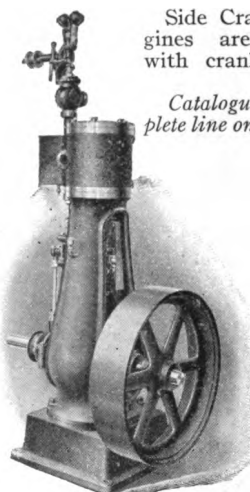
Sizes—3"x3" to 5½"x7"

Shafts and connecting rods are solid steel forgings.

Center Crank Engines designed to operate at very high speeds have counter-balanced crank shafts.

Side Crank Engines are fitted with crank discs.

*Catalogue of complete line on request.*



Centre Crank

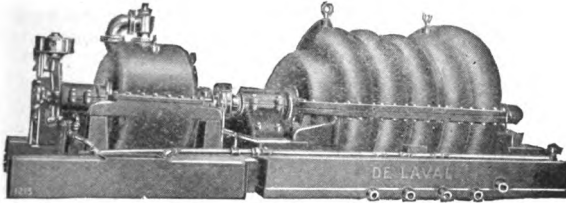
Sizes—3"x3" to 14"x16"



*Steam Turbines, Reducing Gears, Centrifugal Pumps*

## DE LAVAL STEAM TURBINE COMPANY

580 JOHNSON AVE., TRENTON, N. J.



De Laval Steam-Turbine-Driven Compressor, 14650 cu. ft. per min. from 10 in. water column to vacuum to 8 lbs. per sq. in. gage

### THE DE LAVAL STEAM TURBINE COMPANY BUILDS:

**STEAM TURBINES** of the single-stage, velocity-stage, and pressure-stage types, in capacities from 1 to 15,000 H. P. and for all steam conditions.

**SPEED REDUCING GEARS** for steam turbine service in driving ship's propellers, centrifugal fans and pumps, direct-current generators and other slow and medium speed machinery.

**CENTRIFUGAL PUMPS**, including single- and multi-stage, motor or steam-turbine driven for all heads and capacities from direct-driven boiler feeders to the largest geared pumps for water works service.

**CENTRIFUGAL BLOWERS AND COMPRESSORS** for all deliveries and for all pressures up to 125 pounds per square inch.

All De Laval turbines, pumps, and blowers are so far as possible of the horizontally split casing type, with all piping connections on the lower half of

the casing, so that upon removing casing covers and bearing caps, working parts can be inspected or lifted out without disturbing piping.

All De Laval machinery is built to a limit-gage basis so that parts are interchangeable. Each part is stamped with an identifying symbol and can be ordered by wire, if necessary, and inserted in the machine by relatively unskilled persons without requiring to be fitted.

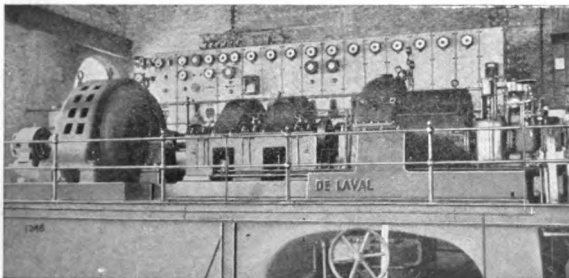
Every De Laval machine is guaranteed as to efficiency and other operating characteristics, and is thoroughly tested before leaving the shop to insure that these guarantees are fulfilled.

Our Engineering Department will gladly co-operate with engineers and others by supplying detailed information regarding characteristics and best manner of using turbines, pumps, gears, compressors, etc.

*State conditions so that we may send appropriate publications describing apparatus suitable for your purposes.*



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1200 K. W. 25 Cycle Alternator Driven by De Laval Geared Steam Turbine

## GENERAL ELECTRIC COMPANY

GENERAL OFFICE: SCHENECTADY, N. Y.

**Manufacturers of Complete Electrical Power Plant Equipments and Supplies**

**PRINCIPAL WORKS:**

Schenectady, N. Y.      Lynn, Mass.      Newark, N. J.      Watsessing, N. J.      Erie, Pa.  
Pittsfield, Mass.      Harrison, N. J.      Cleveland Ohio.      Fort Wayne, Ind.

**SALES OFFICES:**

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Cincinnati, Ohio	*Houston, Tex.	*Oklahoma City, Okla.	Syracuse, N. Y.
Cleveland, Ohio	Indianapolis, Ind.	Omaha, Neb.	Toledo, Ohio
Columbus, Ohio	Jacksonville, Fla.	Philadelphia, Pa.	Washington, D. C.
*Dallas, Tex.	Joplin, Mo.	Pittsburgh, Pa.	Worcester, Mass.
Dayton, Ohio	Kansas City, Mo.	Portland, Ore.	Youngstown, Ohio
	Knoxville, Tenn.		

\*Southwest General Electric Company.

For business outside the United States, address: International General Electric Company, Inc., 120 Broadway, New York, and Schenectady, N. Y., U. S. A.

For business in GREAT BRITAIN, address: British Thomson-Houston Co., Ltd., Rugby, England.

For CANADIAN BUSINESS, address: Canadian General Electric Company, Ltd., Toronto, Ont., Canada.

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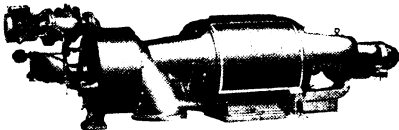
TRADE-MARK  
Guarantee of Excellence on  
Goods Electrical

**TRADE-MARK:**

The products of the General Electric Company comprise practically every kind of apparatus and machinery used in the generation, transmission distribution and use of electrical energy. Its thousands of products, in use in all parts of the world, have established the G-E Trade-mark as the Guarantee of Excellence on Goods Electrical.

**CURTIS STEAM TURBINE GENERATORS:**

The General Electric Company manufactures Curtis steam turbines which are admirably adapted for installation in electric generating stations, and for supplying light and power to mills, machine-shops, laundries, bakeries, breweries, apartment houses, office buildings, railroad stations, etc.; also for driving pumps and auxiliary equipment. Their



200 Kw. A. C. Curtis Steam Turbine Set  
(Type "L" Rigid Frame)

operation is characterized by a minimum of vibration and noise; they are very compact, requiring minimum floor space, headroom and attention. The exhaust steam is free from oil and may be used for heating. These turbines can be furnished for either condensing or non-condensing systems, high, low and mixed pressures, with dry or superheated steam. Full description of the principle, construction and representative installations will be furnished on request for bulletins numbered 42010, 42201, 42206 and 62010. Curtis turbines driving direct current generators can be supplied in sizes 15, 25, 35, 100 kw. and larger, and for driving alternating current generators, in sizes of 100, 200, 300, 500 kw., up to 50,000 kv-a capacity.

**HYDRO-ELECTRIC PLANTS:**

The General Electric Company makes complete electrical equipment for hydro-electric power stations.



Type ATB 24-1750-500 Form V-3500 Volt Vertical Shaft Water Wheel Driven Generator

## GENERAL ELECTRIC COMPANY

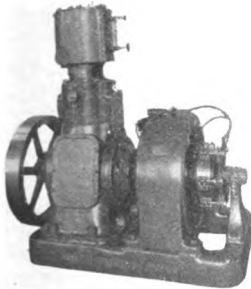
Successful G-E installations are now operated as high as 150,000 volts.

Specific inquiries will be answered by our specialists in hydro-electric power development.

More than 3,000,000 kv-a G-E water wheel driven generators are in successful operation.

### STEAM ENGINE GENERATING SETS:

Steam engine generating sets are made for small plants, and for lighting construction operations in isolated places, requiring 100 kw. or less. These sets are designed to meet the severe conditions of

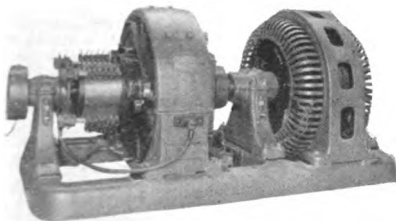


Single Cylinder, Forced Lubrication Engine, with D. C. Generator

marine work, which demand light, compact and durable sets of close regulation and quiet operation. They are used extensively for both power and lighting service. Bulletin 42300.

### MOTOR GENERATING SETS:

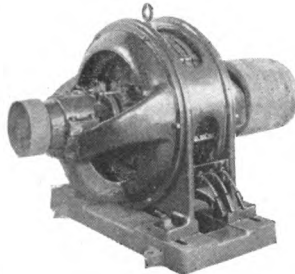
G-E motor generating sets are built in sizes from .2 to 1500 kw. Large sets are used extensively in railway and mine service. Small sets from .2 to 200 kw. are used for excitation purposes. A line of standard motor generators with single-phase, 60-cycle induction motor and shunt wound generators is used extensively for battery charging.



200 Kw. Motor Generator Set

### BELT DRIVEN GENERATORS:

The General Electric Company manufactures belt driven direct current generators in capacity from a fraction of a horse power to 300 kw. unit, in standard voltages. Alternating generators are designed for various frequencies, voltages and phases from 7½ to 550 kw. Detailed information covering these generators will be found in bulletins.

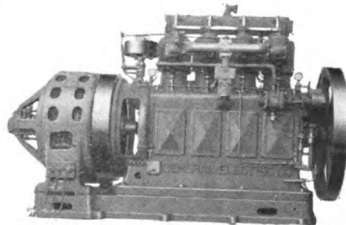


ATB 150 Kw., 900 R. P. M., 2300-Volt, Form PB, 60-Cycle Belt Driven Alternator

### GENERATOR SETS—GASOLINE, OIL OR GAS DRIVEN:

In small machine shops the small single cylinder gasoline, oil and gas engines are very popular. There is a desire to utilize the engine to supply electric current for some service or other; for lighting, and

17



25 KV-A Form A-18 Alternating Current Gasolene-Electric Set

driving small electric drills, grinders, forge blowers, fans, etc.

The ordinary electric generator will not give satisfactory results driven by an engine of the "hit and miss" governor type, for the pulsations in the speed of the engine cause such fluctuations in the speed of the generator that the voltage generated is not constant enough for incandescent lighting or even for motor service.

G-E generators, designed especially for use with such engines, are equipped with heavy balance wheels in the endeavor to eliminate these pulsations.

(Continued on next pages)

(Continued from preceding pages)

## GENERAL ELECTRIC COMPANY

SCHENECTADY, N. Y.

### SYNCHRONOUS CONVERTERS:

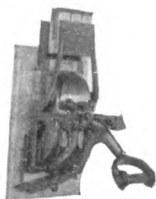
G-E synchronous converters are well known through their extensive use by railroads, electric light and power plants, large industrial projects and electro-chemical operations in all sections of the country. The G-E portable, synchronous converter substation, consisting of a converter, transformers, switchboard and accessories, is widely used in railway work and industrial plants where additional temporary power is required. For industrial service it is often desirable to transform a small amount of power from alternating to direct current, in which case Type TC 25 to 100 kw. capacity 115- or 250-volt unit may be specified. Bulletin 42500.

### OIL CIRCUIT BREAKERS:

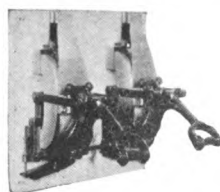
- 18 For potentials as high as 155,000 volts and currents up to 5000 amperes the General Electric Company offers a series of oil circuit breakers which are backed by years of experience in design and oil breaker service.

### AIR CIRCUIT BREAKERS:

As an index to the quality in excellent design of the G-E air circuit breakers, we would direct your attention to the twenty years of satisfactory operation in the railway and industrial fields. These are made in the hand operated type, solenoid operated type, motor operated type and the pneumatically operated type.



Type CK-2



Type CK Double Pole

### INSTRUMENTS:

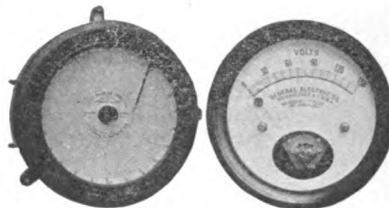
The General Electric Company has designed, developed and carried to perfection a complete line of measuring, indicating and recording instruments such as will fit the ends and requirements of any industrial enterprise. These are all of such mechanical excellence that they have become the standard of highest grade instruments.

Full information relative to instruments will be found in bulletins, some of which are given below:

	Bulletin
Ammeters and Voltmeters, Curve Drawing, Types CR, CR-2 and CRP.....	46021
Direct current, Types D-7 and D-8.....	46017
Electrical Inst.—Laboratory Use.....	4783
Indicators and Detectors.....	46022
High Capacity Portable Wattmeter....	46029
Lamp Testing Watt Ind., Type L.....	4609
Portable Am., Volt and Wattmeters, Type P-8.....	46018A
Oscillograph, Electromagnet Type.....	46111
Synchronism Indicator.....	46015
Temperature Indicator.....	46028
Type G Demand Meters.....	46104A
Type M Demand Meters.....	46103A
Type P Demand Meters (Printometers)...	46101A
Voltmeters, Electrostatic.....	46110
Wright Demand Indicator.....	4533

### SWITCHBOARD INSTRUMENTS:

The General Electric Company makes direct current and alternating current instruments designed upon the well-known D'Arsonval principle. They are dead-beat, have legible uniform scales and are



Switchboard Type CR Ampere 60 Cycle Curve-drawing Ammeter      Type DE Semi-Flush Switchboard Voltmeter Rated at 0-150 Volts

protected from stray fields. These instruments range upward to 3000 amperes.

G-E Portable A. C. and D. C. instruments of extreme accuracy are recommended for laboratory use. Curve drawing instruments of excellent design and satisfactory operation are also made.

# GENERAL ELECTRIC COMPANY

## TRANSFORMERS:

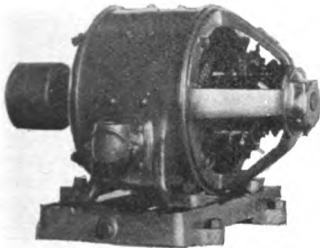
For power service the General Electric Company is prepared to build transformers in all sizes. The highest voltage now in commercial transmission service is 150,000 volts. Information concerning the above should be obtained from our nearest office. For distribution service used in connection with light and power circuits the type H transformer is used. The operation of textile machinery, such as drawing frames, combers, warpers, etc., may be materially improved by installing a G-E Type M transformer for operating electric stop-motion magnets. One transformer can operate 20 machines and can be furnished for any voltage and frequency.



75 KV-A Form "K" Transformer

## D. C. CONSTANT SPEED MOTOR:

RC type of motor with commutating poles may be classed as the universal direct current motor. It is especially designed to meet the majority of conditions required of motors. Can be furnished either shunt wound for close speed regulation, compound wound for heavy starting torque or where violent power fluctuations occur, or series wound where load



Type RC 15 H. P., 1150 R. P. M., 230-Volt Shunt Wound Motor with Sliding Base and Pulley

either requires fixed values or may be made subject to automatic or manual control.

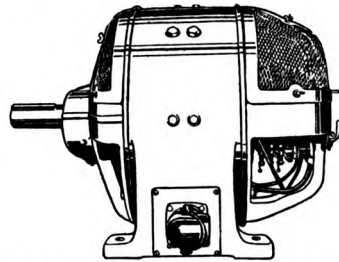
All RC motors will be shipped for floor installations. May be readily arranged for wall or ceiling suspension.

Ratings for open, semi-enclosed, self or separately ventilated types, from 1/2 h. p. to 150 h. p., 115, 230 and 550 volts. Bulletin 41013.

## D. C. ADJUSTABLE SPEED MOTOR:

RF adjustable speeds, commutating pole motors have been designed for machine tool and similar service where wide-spread variation and adjustment of speed independent of load is required.

Made for direct current only, in voltages

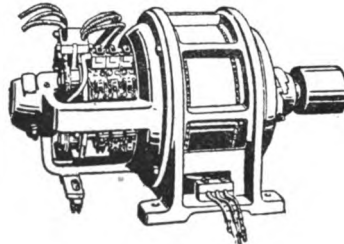


Type RF Reversible Planer Motor

of 230 and 550 and in ranges from 2 h. p. to 50 h. p. Speed adjustment 2 to 1, 3 to 1 or 4 to 1 to meet requirements. Bulletin 41021.

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## A. C. BRUSH-SHIFTING MOTOR:



BTS Alternating Current Motor

BTS Alternating Current Motors. These motors give an infinite number of speeds and high efficiency to all of them. Motors have been developed in 60 cycles from 10 to 100 h. p., inclusive. Slow speed 25-cycle motors can be furnished for 100, 125 and 150 H. P.

## A. C. SINGLE-PHASE CONSTANT AND VARYING SPEED MOTORS:

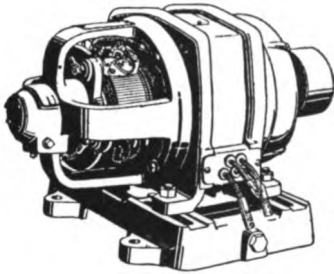
Type RI, constant speed, single-phase, induction motors are furnished in sizes 1/4 h. p. to 15 h. p., frequencies 25, 40 or 60 cycles. Bulletin 41507A and De-

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# GENERAL ELECTRIC COMPANY

SCHENECTADY, N. Y.



Type RI Constant Speed Motor

scriptive Sheet 61200. Type BSS, single-phase, varying speed brush shifting motors are furnished in sizes  $\frac{1}{4}$  h. p. to  $7\frac{1}{2}$  h. p., 1200 to 1800 r. p. m., 60 cycles.

The Type BSS is suitable for constant torque, belted or chain drives (fans and blowers, printing presses, refrigerators and laundry machinery, etc.). Full information is given in Descriptive Sheet 61401. Reversing service, Type RI motors are furnished in sizes  $\frac{1}{4}$  h. p. to 5 h. p. Reversible RI motors are especially useful for application to elevators, small cranes and hoists, laundry machinery, etc.

## A. C. POLYPHASE CONSTANT AND MULTISPEED MOTOR:

Form KT Polyphase Induction Motors are built of either riveted or skeleton frame. These motors range from  $\frac{1}{4}$  h. p. to 750 h. p. Standard rating: 110 volts,  $\frac{1}{4}$  h. p. to 15 h. p.; 220 volts,  $\frac{1}{4}$  h. p. to 100 h. p.; 440 and 550 volts,  $\frac{1}{4}$  h. p. to 750 h. p.; and 2200 volts, 20 h. p. to 750 h. p. Adaptable for driving all classes of machines requiring constant speed. They are extremely simple, have great overload capacity and a high power factor. Bulletin 41302.

## A. C. VARIABLE SPEED MOTOR:

Form M motors are adapted for service requiring frequent starting under load, or starting of loads with high inertia. Standard rating, 60 and 25 cycles up to 200 h. p. Special rating to 6000 h. p. Bulletin 41302. High speed Form M induction motors, ranging from 75 h. p. to 350 h. p., 1800 r. p. m. for direct connection can be furnished.

## A. C. CONSTANT AND VARIABLE SPEED MOTOR:

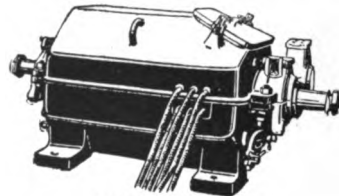
Form HI Alternating Current Motors are specially designed for mining service.

They have high starting effort, and large capacity for severe overloads; have an unusually strong mechanical construction and are semi-enclosed, self-ventilated. Built in sizes of from 5 h. p. to 75 h. p., 3-phase, 60 cycles, 220, 440 and 550 volts, with or without back gearing.

## A. C. AND D. C. MILL TYPE CONSTANT SPEED MOTORS:

MI and MD mill type motors, for severe steel mill service, require special designs.

In addition to cranes and reversing auxiliary machinery in steel plants, mill type motors can be applied with advantage as follows: Ore and Coal Bridges and Unloaders; Charging Machines of all types. Heavy duty fabricating shop and erecting shop cranes, factory cranes, electric shovels, gates, valves, etc., small heavy duty hoists.

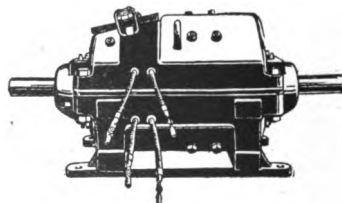


MI Mill Type Motor

Furnished totally enclosed in sizes from 3 h. p. to 150 h. p. for 25-cycle, 220- and 440-volt A. C. and 230- and 550-volt D. C. Open type motors are furnished from 25 h. p. to 150 h. p. A. C. and 6 h. p. to 200 h. p. D. C. for continuous duty.

## D. C. CRANE AND HOIST VARYING SPEED MOTORS:

CO 1800 crane and hoist motors are designed for intermittent service requiring a maximum torque motor of ample overload capacity, enclosed, reversible and series wound. Suitable for floor, wall or ceiling mounting. Furnished with or without back gear.



CO 1800 Crane and Hoist Motors

## GENERAL ELECTRIC COMPANY

Sizes range from 2 h. p. to 65 h. p., 115 and 230 volts, and to 50 h. p., 550 volts. Electric brakes of half or full torque capacity can be supplied to insure a quick sure stop. Bulletin 48100.

### A. C. HOIST VARIABLE SPEED MOTOR:

MTC and ITC alternating current, 3-phase motors give a maximum torque for a given weight and are very strong mechanically. They are used for hoists and any kind of work of an intermittent nature where the limitation comes from torque required rather than from heating. Furnished in capacities of 1 h. p. to 300 h. p., 60, 40 and 25 cycles.

### SYNCHRONOUS MOTORS:

While the synchronous motor may be applied to most any industrial service, its greatest value is obtained when used on circuits which indicate a need for power factor correction.

Some of the indications are as follows:

1. When the power factor is low and greater generator, transformer or feeder capacity is required.
2. When power is purchased at a rate which is now, or shortly may be, dependent upon the power factor of the load.
3. When the voltage regulation is poor on account of an existing induction motor load and production falls off in consequence, synchronous motors will raise the average voltage and help keep it constant.
4. When continuity of operation is imperative and dirty operating conditions make a small motor air gap inadvisable.

The General Electric Company has designed complete lines of synchronous motors covering a wide range of speeds and capacities which are in extensive use throughout many industries driving rolls, compressors, pumps, grinders, crushers, blowers, fans, conveyors, mills and refrigerating machinery.

For industrial drives these motors are furnished from 25 to 2000 h. p. capacity with speeds from 80 to 1800 r. p. m. and are designed to start any load met with in commercial practice without excessive current demands upon the power circuit.

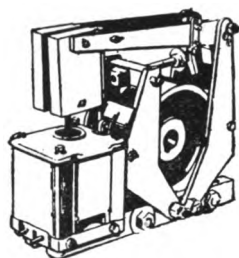
Our engineers will be pleased to supply additional information on these motors.

### CONTROL APPARATUS:

We make and will be glad to furnish all auxiliary equipment with our motors such as Starting Rheostats, Speed Regulators, Drum Controllers, Automatic Self Starters with accessories for remote control, Compensators and Solenoid Brakes. Send for descriptive bulletins.

### AUTOMATIC SOLENOID BRAKES:

Solenoid brakes render excellent service in the automatic, quick stopping of rotating parts, and are usually mounted upon the driving shaft. As soon as the power is cut off, the brake sets and applies a retarding force to the shaft. The General Electric Company has developed both direct current and alternating current solenoid brake of the best



CR 9510 Automatic Solenoid Brake

construction and design, automatic and self-adjusting in action. They are made for motors of 1 h. p. and up, having equal breaking torque in both directions of rotation.

G-E solenoid brakes give a retarding torque at one foot radius on the brake wheel shaft of not less than the full load torque of the motor on which it is used and a maximum "holding torque at rest" at about 110 per cent of full load torque. Lesser degrees of braking may be obtained through adjustments, in some cases as many as fifteen adjustments being possible. Send for Bulletin 48900.

### MAGNETIC CONTROL FOR MACHINE TOOLS:

Magnetic control is a safe, convenient and economical method of protecting the machine and the operative. The General Electric Company makes standard direct current equipment for constant speed reversing and non-reversing and adjustable speed, reversing and non-reversing.

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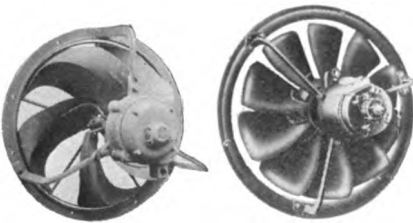
## GENERAL ELECTRIC COMPANY

SCHENECTADY, N. Y.

These sets are furnished to meet the requirements of each machine such as constant speed non-reversing equipment on presses are subject to push-button control. Send for Bulletins 68412-68418, for illustrations of applications.

### MOTOR DRIVEN EXHAUST FAN OUT-FITS:

These exhaust fan outfits are self-contained units, adapted for ventilating shops, factories, office buildings, etc., or for use in dyehouses, laundries, paper mills and other industrial establishments where it is desirable to remove steam, moist air, dust, smoke and odors, or to



**Riveted Frame Induction Motor, Direct Connected to Davidson Fan**      **Ventura Disk Fan with Direct Current Motor**

exhaust noxious gases and fumes which attend certain processes of manufacture. Also may be usefully employed to dry cloth, paper, wool, tobacco, asbestos, bricks, clay and many other articles of merchandise. Made for both alternating and direct current standard voltages, ranging in sizes from 18 to 48 ins.; capacities from 650 to 25,900 cu. ft. of air per minute.

### FURNACES:

The General Electric Company makes several types of furnaces for air drying, annealing, hardening, forging, melting, tempering, etc.

The electric hardening furnace reduces to a minimum the breakage and warping from uneven heating or burning due to excessive temperature permitted by careless operators. Tools are hardened with absolute uniformity as the baths are controlled by an electric pyrometer. Send for Bulletin A-4066.

Our electrically heated oil tempering baths are an immediate, uniform and definite process of tempering from which

the personal element, uncertainty, oxidizing and fire hazard are entirely eliminated. They may be used on direct current or alternating current. The temperature of the oil is easily controlled and varied by regulating switches and an easy reading thermometer indicates exact temperatures so that only unskilled labor is necessary. The operator is protected from heat by a three inch mineral wool insulating jacket. Send for Bulletin B-3265.

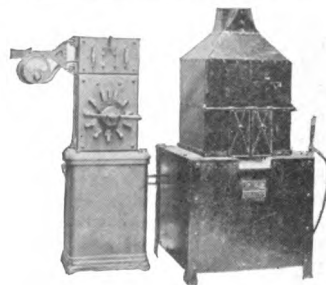
### TEMPERATURE INDICATOR:

For indicating continuously temperatures of switchboards and various operations of the windings of electrical machinery under operation conditions, the General Electric Company offers a convenient and excellently designed temperature indicator. It is accurate, positive and quick acting.

### INDUSTRIAL HEATING OVENS:

Electric heat may be applied to ovens with a higher efficiency, increased production, elimination of excess handling and no storage of fuel and reduction of fire hazard as the gain over other methods. Electric ovens give perfect heat distribution and constant temperature.

It is important, however, to note that electric heat cannot be used in all cases to advantage and the problems involved



**Electric Hardening Furnace Outfit**

should be investigated thoroughly by heating experts, so that the legitimate use of electric heat may not be handicapped through the improper applications.

The General Electric Company has developed electric heater units together with auxiliary apparatus to operate up to temperatures of 900° F.



## GENERAL ELECTRIC COMPANY

These equipments are recommended for baking japan, oil-enamel, insulation materials, compounds, foundry ovens for drying paints, varnish, lumber, fiber, tempering steel, glue heating, alloy, melting and paraffin, wax and varnish heating. Send for Bulletin 48709.

### G-E THERMOSTATIC METAL:

For problems of production or operation in which heat is the governing or limiting element of rate per unit or period of activity, G-E Thermostatic Metal presents a solution.

It is a duplex metal prepared by uniting permanently through their entire length two metals of widely different coefficients of expansion. It has the added advantage of giving the maximum deflection obtainable, reliability, permanent union unaffected by distortion, corrosion-resisting properties and exerts considerable force for the mechanical operation of various devices without becoming permanently set.

This metal is manufactured in standard thicknesses ranging from 0.015 to 0.25 inch; widths up to 6 inches; lengths up to 36 inches. Can be made to special specifications of customer. Send for Booklet B-3435.

### THERMOSTATS:

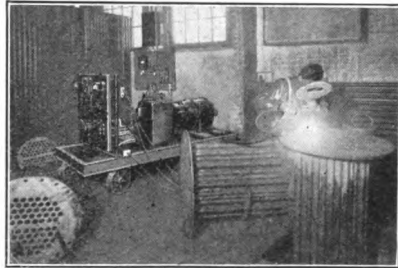
Unaffected by vibration or moisture the CR-2990 thermostat is the instrument to give satisfactory service, positive operation on either alternating or direct current service. It permits of accurate adjustment over a range of temperature from 20 to 212° F.

### ELECTRIC SHERARDIZING:

Electric heat is ideal for this method of protective coating. The General Electric Company has developed a furnace for this process which insures a coating of uniform thickness, durability and smoothness. Articles treated by this process may be bent, swaged or otherwise deformed if at ordinary room temperatures without injury to the coating. The equipment consists of an electrically heated, revolving drum mounted on pedestals. The driving motor is mounted on a pedestal and is geared through reduction gears to drum. The heating elements are so distributed about the drum that the heat supplied is always even. An angle thermometer extends through the walls of the drum so that the temperature may be readily observed and regulated by attendant. Send for Bulletin 48926.

### ARC WELDING APPARATUS:

The principal advantage of the Electric Arc Welding process is that large amounts of energy are transformed into heat in a very small space. The heat is confined to the immediate locality of the weld and accordingly does not spread out over the



Constant Energy Arc Welding Set

adjacent space. This reduces materially the expansion and contraction troubles, and at the same time results in a high heat efficiency. A further result of the great concentration of heat is to produce a very high temperature which is sufficient to immediately fuse the metal which it is desired to weld. It is not necessary in starting a weld on steel to preheat or to wait until the metal can be brought in the fusing temperature.

Practically all arc welding is accomplished by one or two methods commonly referred to as either metallic or carbon electrode method.

In the metallic electrode method, the electrode consists of a wire or rod held in a suitable holder. The heat of the arc, in addition to melting a small pool on the work, melts the electrode away and the current causes the molten metal to be driven, in finely divided particles, against the work. In this manner additional metal is built on or used to join two pieces of metal. By this method, metal can be deposited on vertical surfaces, and it is the only way in which metal can be successfully deposited overhead.

The metal deposited by this method is more uniform and a weld so made is stronger and has a smoother and more regular appearance than one made by the carbon electrode. For these reasons the metallic electrode is used when strength or appearance is important.

(Continued from preceding pages)

## GENERAL ELECTRIC COMPANY

SCHENECTADY, N. Y.

**ARC WELDING APPARATUS (Con'td):**

The carbon electrode method is used for building up metal, plugging holes in castings, welding, and joining parts where strength and appearance are not essential, or where the surface is to be machined off. Since heavy currents can be used, metal can be built on with great rapidity, and where speed is desirable this method is applicable.

In the carbon electrode method a carbon rod is substituted for the metal electrode. The arc fuses the metal of the work and additional metal is built on by melting from a rod of filling material in a manner similar to soldering with an iron or welding with a gas torch.

For cutting, or melting away excess stock, the carbon electrode is used. In cutting the arc is held stationary at a point on the work where, when the metal is fused, it is free to flow or run off. As the molten metal runs away the arc is advanced and in this way a cut is made through the piece.

24 Welds, which are soft enough to be machined, can be made by using either method if reasonable care is taken. The deposited metal should not be chilled and if the carbon electrode is used the arc should be kept long enough to prevent carbon being carried into the weld. Other than the above causes, hard welds are usually due to poor quality of electrode metal or filling metal.

The deposited metal is obviously cast steel, since it is merely fused in place and is not ordinarily subjected to any mechanical working afterward. The metal will have the coarse crystal structure found in unannealed cast steel and likewise will have comparatively low values for reduction in area and elongation when specimens are tested in a tensile testing machine. In some cases the tensile strength of the metal in the weld may be as high as 55000 to 60000 lbs. A safe figure is 35000 lbs. where the work is done by experienced welders.

The Wirt Jones Tests of the Research Subcommittee on Arc Welding of the Emergency Fleet Corp., as reported in a paper before the A. I. E. F., show a range in tensile strength of from 38600 to 62600 lbs. per square inch in welds made by direct current bare electrode, arc welding. These welds were machined down to the same thickness as the plate before the tests were made. The elongation found varied from 4% to 13%. The

amount of power required for welding depends largely upon the source of supply.

The following table shows the approximate kilowatt input required for various systems, assuming 150 amperes in the arc:

	Kw. or Kv-a
A. C. 100 volt supply.....	15
75 volt constant potential.....	15
60 volt constant potential.....	12
A. C. 110 volt supply.....	7
40 volt constant potential.....	8
Constant energy equipment with supply motor-generator set.....	7.65
Constant energy equipment operat- ing from 125 volt line.....	5.35

Should any considerable number of operators be employed it will become at once apparent that the outfit requiring low input is very much to be desired, as the cost of operation is reduced by such a large amount.

**TYPES OF EQUIPMENT:**

There are several principal types of welding equipment among which are:

(1) Constant energy, self-excited Generator.

(2) Constant energy balancer sets.

(3) Constant Potential Generator with auxiliary equipment.

(4) Alternating current welder.

All except the constant potential type are primarily single operator individual equipment suitable for bare metallic electrode welding only. The constant potential type may be used as a single operator equipment for either carbon or metallic electrode welding or a number of operators may work from one machine. This type of machine also permits the use of the carbon electrode for cutting.

The equipment for each type of apparatus may be outlined as follows:

The constant energy, self-excited generator is arranged for belt drive, to be directly connected to direct current motor or to 60-cycle, 3-phase alternating current motor.

This type may also be direct connected to 25- or 50-cycle alternating current motors or to alternating current motors of any of these frequencies wound for two-phase circuits, the maximum voltage being 550. It can also be direct connected to Gasoline Engines or to other engines or speeds of either 1200 to 1500 R. P. M.

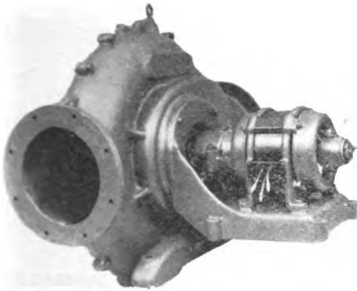
The constant energy balancer sets are suitable only when 110 to 125 volt D. C.

## GENERAL ELECTRIC COMPANY

is available. If the circuit has the positive side grounded it is entirely satisfactory. If not, special precaution must be taken.

### CENTRIFUGAL COMPRESSORS:

There is an increasing demand for the centrifugal air compressor because of its many advantages over that of other types. It is more efficient, dissipating little energy in the form of heat. The absence of moving parts lessens loss by



Motor Driven Centrifugal Compressor

wear and slippage or shut-down due to renewals. There are no belting or gears.

In operation and appearance it is similar to the well-known centrifugal pump, having an impeller mounted on a shaft and surrounded by a stationary set of discharge vanes and arranged in a suitable casing.

Its maintenance and repair costs are very low in comparison with other forms of compressors. It requires less floor space. The pressure delivered is always uniform, eliminating the necessity of storage tanks. It is built in any capacity up to 55,000 cubic feet per minute at 30 pounds. It is furnished with three types of drive, an induction motor for constant speed service, direct current motor with auxiliary apparatus for starting and controlling speeds or a Curtis Steam Turbine, which permits of a wide range of speeds.

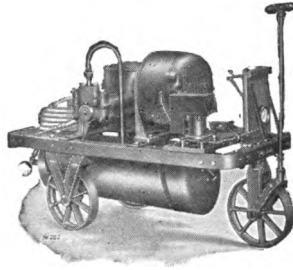
It is applicable to the following types of service: Oil and Gas Furnace; Pulverized Coal Burning; Agitation of Liquids; Foundry Cupola; Ash and Coal Conveying by Suction Conveying systems; Pneumatic Conveyors; Carburetted Water Gas Manufacturing Blast Furnaces.

These compressors may be fitted with a constant volume governor which is simple acting, positive, accurate and safeguards machinery in case of their breakdown. Send for Bulletin 48609.



### PORTABLE AIR COMPRESSORS:

The small G-E reciprocating compressors, such as are used to supply air brakes on electric street cars, are particularly applicable for blowing out machinery in industrial plants. These compressors are built with either induction motors or direct current motors of any commercial frequency or voltage. The motor and compressors are so designed and built as to form one unit.



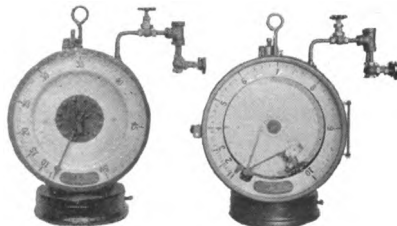
Portable Air Compressor

These compressors are furnished either as portable sets or as stationary equipments complete with automatic pressure governor, reservoir, line switch and fuses and pressure gage. For blowing out electrical apparatus or knitting machinery and the like, either machines of 15 or 25 cu. ft. displacement per minute are used at pressures of 50 or 60 lbs. per sq. in. gage. Bulletin A-4069.

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### G-E FLOW METERS:

The G-E flow meter provides a means for accurately measuring the total flow of steam, water, air or gas through pipes or closed conduits, and so furnishes information of great value in the economical management of any manufacturing industry or central station.



G-E Indicating Flow Meter

G-E Indicating, Recording and Integrating Flow Meter

They are built in the indicating, recording and integrating type; recording and integrating type; indicating and recording type; recording type and indicating type. Bulletin 46501-B.

## KERR TURBINE COMPANY

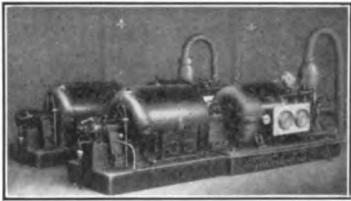
WELLSVILLE, N. Y.

Offices in All Large Cities

**Manufacturers of Kerr Economy Steam Turbines and Reduction Gears**

### KERR ECONOMY STEAM TURBINES:

Made in the following types: Velocity stage, multi-pressure stage or combination velocity multi-pressure stage. Our



**Two 750 KW. Kerr Economy Turbo Alternators  
Installed for the City of Springfield, Ill.**

26

flexibility of design and construction permits of economical operation on any combination of initial and exhaust pressures, without special design or excessive cost. A sufficient number of stages can always be offered to insure good economy with low steam velocities and consequent absence of bucket erosion, resulting in exceptionally low interest and depreciation charges.

Kerr Economy Steam Turbines can be offered for operation under any of the



**35 KW. Kerr Economy Turbo Generator Set.  
Thirty of This Particular Type Have Been  
Sold to the U. S. Navy**

following conditions:

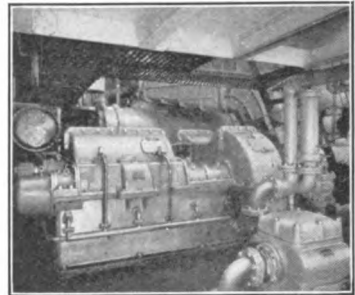
- High pressure condensing.
- High pressure non-condensing.
- High pressure condensing permitting of automatic steam extraction.
- Low, or mixed pressure.

### KERR ECONOMY REDUCTION GEARS:

Cut on the most accurate gear hobbing machines obtainable. A wide range of sizes insures the same flexibility that is the salient feature of Kerr Economy Turbines.

### KERR ECONOMY PROPULSION MARINE TURBINES:

Made in the combination velocity multi-pressure stage type. The turbine proper may contain a single rotating element,



**2650 S. H. P. Kerr Economy Propulsion Marine  
Turbine and Gears Installed in an 8800 Ton  
Cargo Steamer**

or may contain two rotating elements, a high pressure and a low pressure, forming what is known as the cross compound type. The speed of the turbine is reduced to the speed at which the propeller operates by means of a set of Kerr Economy Reduction Gears. These gears may be furnished for either single or double reduction, as desired by the Purchaser.

Our smaller turbines are especially well suited for driving marine type generators, pumps and blowers. Our numerous installations have proven their thorough reliability.

# MOORE STEAM TURBINE CORP'N

WELLSVILLE, NEW YORK

## DISTRICT OFFICES

NEW YORK  
CHICAGO

DETROIT  
CLEVELAND

BOSTON

PITTSBURGH  
PHILADELPHIA

ST. LOUIS  
ST. PAUL

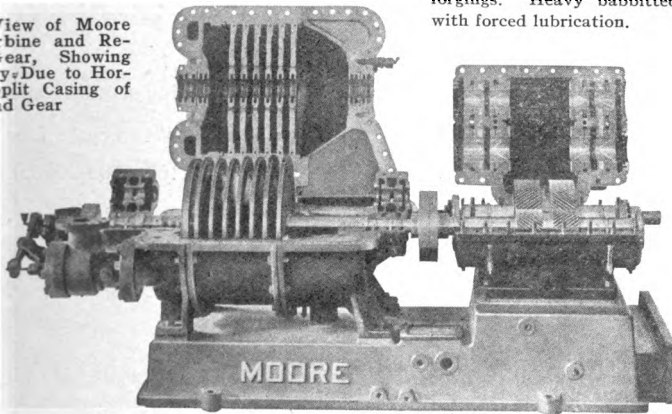
Manufacturers of Single- and Multi-Stage Steam Turbines,  
Condensing and Non-Condensing

### MOORE STEAM TURBINES:

The latest and best ideas in the design and manufacture of steam turbines are embodied in the Moore Steam Turbines due to the long experience of this company in this field.

Single- and Multi-stage turbines of the condensing and non-condensing types are manufactured. Ample supply of repair parts is always in stock. Sizes range from 5 to 1000 H. P.

Typical View of Moore Steam Turbine and Reduction Gear, Showing Accessibility Due to Horizontally Split Casing of Turbine and Gear



Governors: Are used depending on size of turbine and service.

Carbon Packing is provided, brass shrouded for protection. Packing will not cut shaft: steam-tight when properly fitted.

Gearing: Moore Double Helical Reduction Gears are solid forgings or carbon steel rings shrunk on C. I. centers. The Pinions are chrome nickel or chrome vanadium steel forgings. Heavy babbitted Bearings with forced lubrication.

27

### CONSTRUCTION:

The Turbine Casings and Diaphragms are permanently joined and the combination is split horizontally. The two, as a unit, may be removed, for inspection.

The Rotor is a single velocity stage wheel carrying two rows of moving buckets, followed by two or more, steel pressure stage wheels, all mounted on the same steel shaft. The first stage wheel is built up, or solid forged construction.

The Buckets are of steel, perfectly smooth, and are removable for renewal.

The Nozzles First Stage are cast bronze: diverging, expanding type. Second and following Stages are sheet metal strips cast into diaphragms.

Reversing Vanes are used between the two rows of moving buckets of the first stage wheel.

Bearings: High speed service; ring or forced lubrication, or both; size and operating conditions governing.

Adjustable thrust bearings are provided.

Coupling: Latest improved flexible type.

Oil relay or direct connected type.

### POINTS OF SUPERIORITY:

1. High efficiency.
2. Low steam velocity.
3. Accessibility.
4. Emergency Governor.
5. Carbon packing.
6. Moderate speeds.
7. Improved method of attaching Diaphragms.
8. Smooth Buckets with perfect alignment.

### WE ARE PREPARED TO QUOTE ON:

Condensing and non-condensing single- and multi-stage steam turbines—5 to 600 H. P.

Double Helical Reduction Gears.

Turbo Alternator Units.

Geared and Direct Connected Turbo-Generator Units, Turbo Blowers, and Turbo Pumps.

Geared Belted Turbines.

Consult our engineers, always at your service, without placing you under any obligation. Send for catalog.

## BUSCH-SULZER BROS.-DIESEL ENGINE COMPANY

ST. LOUIS, MO.

**Designers and Builders of Diesel Engines since 1898**

*Owners of all DIESEL ENGINE Rights and Experiences, in and for the U. S. A. and its possessions, Canada and Panama, of the Diesel Motor Company of America, the American Diesel Engine Company, Sulzer Bros. of Winterthur, Switzerland, and Rudolf Diesel (Inventor of the engine).*

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### STATIONARY ENGINES:

#### Vertical

For direct connection or transmission;  
also suitable for Marine Auxiliaries.

In the following standard sizes:

28      Type "4-B," four cycle, four cylinder,  
120, 165, 250, 365, and 520 B. H. P.

Type "4-C," two cycle, four cylinder,  
750, 1275, and 2000 B. H. P.

### MARINE ENGINES:

#### Vertical

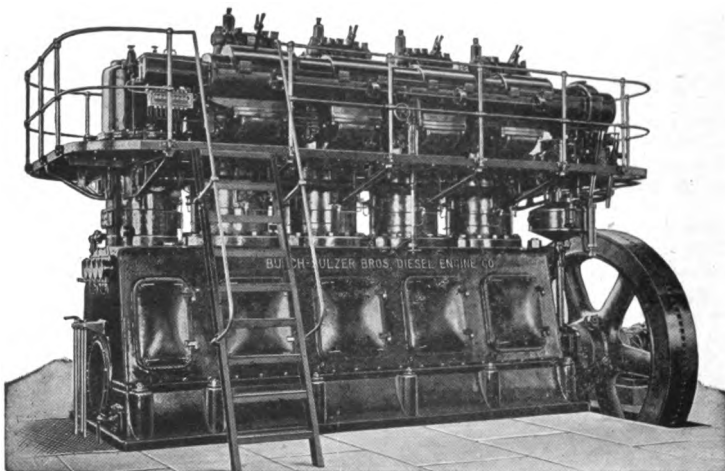
Directly reversible, for coupling to the  
Propeller Shaft.

In the following standard sizes:

Type "4-CM," two cycle, four cylinder,  
550-650, 950-1100, 1500-1750, and 1700-  
1900 B. H. P.

Type "6-CM," two cycle, six cylinder,  
850-975, 1400-1650, and 2550-2900  
B. H. P.

Special Light-weight, High-speed  
"Submarine" type Diesel Engines.



520 B. H. P.—Type "B"—Stationary Diesel Engine

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## FULTON IRON WORKS CO.

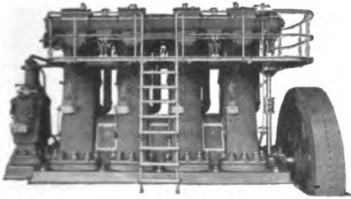
Established 1852

MAIN OFFICE AND FACTORY, ST. LOUIS, U. S. A.

Builder of Fulton Diesel Oil Engines

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### FULTON DIESEL OIL ENGINES:



**360 B. H. P. 4-Cylinder Fulton Diesel Oil Engine**

The Fulton Diesel oil engine is built in 4-cycle, vertical, multi-cylinder, open "A" frame, in 3-, 4- and 6-cylinder arrangements.

It is designed to operate on commercial grades of petroleum, crude or fuel oils or tar oils with the greatest economy and reliability.

The engine is a full Diesel type engine of the highest detailed refinement, ignition being insured by heated compression, no hot bulb, electric spark or exterior means of ignition being employed.

The FULTON Diesel oil engine can be started from cold in one minute without any waste of time or trouble.

The operation of the engine is comparatively quiet, very clean and safe, which permits its application and use for all power purposes.

The tanks for the storage of fuel oil may be located at any convenient place, buried under buildings, driveways or other convenient locations, thus conserving space for other purposes.

The engine is built in sizes ranging from 150 B. H. P. upwards and is suitable for any power purpose, including electric light and power plants, pipe lines, water works, flour mills, textile mills, irrigation plants, etc. The engine is built for the most exacting requirements and heavy duty service.

**FULTON**  
DIESEL OIL ENGINES  
REG. U.S. PAT. OFF.

*"Over Sixty-seven Years of Successful Manufacturing."*

# McINTOSH & SEYMOUR CORPORATION

MAIN OFFICE AND WORKS

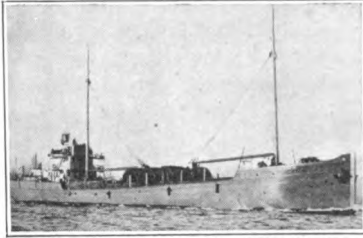
AUBURN, N. Y.

149 Broadway  
NEW YORK CITY

700 Interstate Bldg.  
KANSAS CITY, MO.

815 Sheldon Bldg.  
SAN FRANCISCO, CAL.

**Builders of Stationary and Marine Diesel Type Oil Engines**



**MOTORSHIP "ALABAMA"**

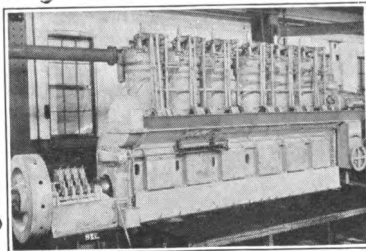
Equipped with a Pair of Our 640 I. H. P.  
Heavy Duty Diesel Type Marine Engines.

**30**

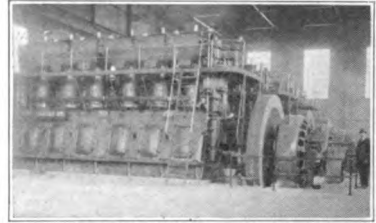
**SIZES AVAILABLE.**

I. H. P.	R. P. M.
390	265
640	190
960	135
1300	138
1550	115
2000	105

All Four Cycle Six Cylinder and Directly Reversible.



**ONE OF THE 640 I. H. P. ENGINES IN THE  
MOTORSHIP "ALABAMA"**

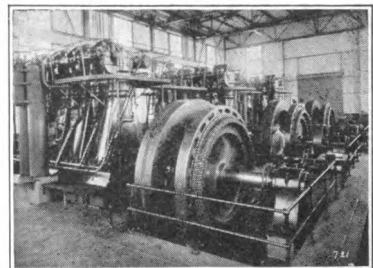


**1000 B. H. P. STATIONARY ENGINE**

The above is the Power Plant of a modern Cement Mill and contains four 1000 B. H. P. units.

We have engines of these types available in sizes from 100 B. H. P. to 1600 B. H. P.

The Central Station shown below has been in operation four years on twenty-four hour service and is now feeding into the main transmission system.



**CENTRAL STATION WITH THREE 500  
B. H. P. ENGINES**



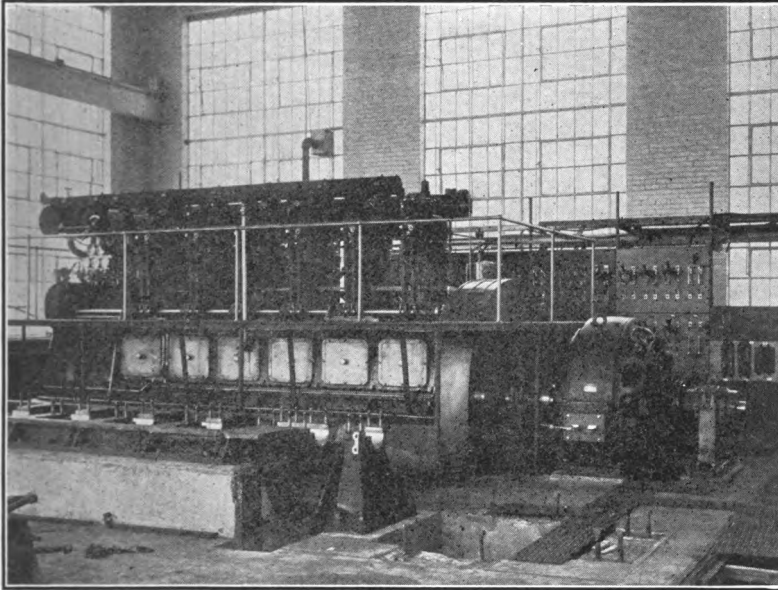
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# NEW LONDON SHIP & ENGINE CO.

GROTON, CONN., U. S. A.

Manufacturers of Stationary and Marine Diesel Engines

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31

**360 H. P. Four-Cycle Nelseco Diesel Crude Oil Stationary Engine**

## **NELSECO DIESEL ENGINES:**

Burn the same cheap fuel oil, or crude,  
as is commonly used under steam boilers.

Nelseco Diesel engines are always ready  
for instant starting.

They are simple in design, construction,  
and operation—and the upkeep very  
low.

**Over 100,000 H. P. in Service**

**and**

**Over 50,000 H. P. Building**

**Or on Order**

*Gold Medal of Honor—Panama Pacific  
Exposition.*



**TRADE MARK**

*Adopted by United States and Foreign  
Governments.*

## THE ANDERSON FOUNDRY & MACHINE CO.

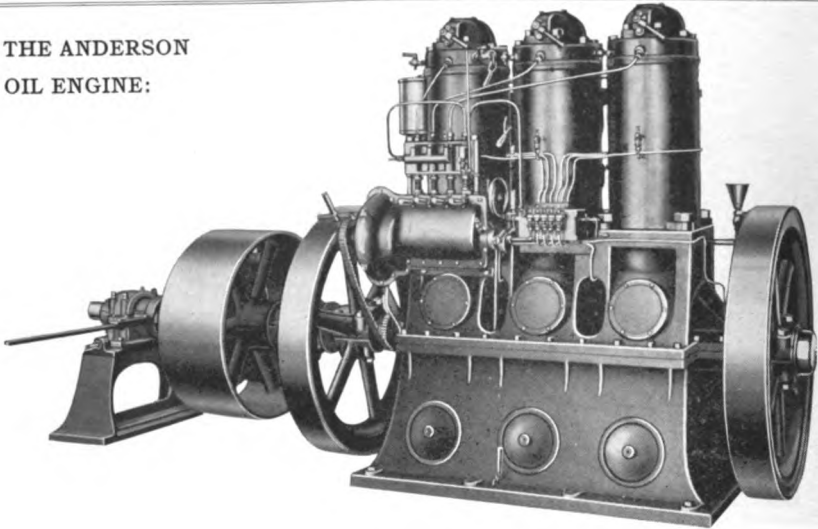
Established 1872

ANDERSON, IND.

NEW YORK OFFICE: SINGER BUILDING

Oil Engines; Brick and Tile Presses; Tin Plate Machinery; Gray Iron Castings;  
Special Machinery

THE ANDERSON  
OIL ENGINE:



32

Two Cycle—Heavy Duty—Moderate Speed—Low Compression—Solid Fuel Injection—Deflector Hot Plate Vaporization and Ignition, by which all carbon deposits in the cylinder are eliminated.

Operates economically on all kinds of fuel, kerosene to Texas Navy Fuel Oil, 18° Baumé, with no adjustments whatever.

Force feed lubrication for cylinders—Continuous pressure circulating system for the main bearings, crank pins and other moving parts, insuring the least possible lubricating oil consumption.

Small Floor Space—Low Head Room—Light Weight.

Everything controlled from one position—Air Starting Valve—Individual Pump Levers—Air Control—Slow Down and Stop Control—Time of Fuel Injection Control—Lubricators—Water Injection.

Simple and easy to start. Runs in either direction with no special adjustments.

Low First Cost—Low Maintenance—Least possible operating cost.

Suitable for all stationary power purposes.

Arranged with special base and reverse gear for marine purposes.

*Detailed Specifications and Prices on Request.*

### DATA

Horse Power	Cylinders			R. P. M.	Floor Space	Shipping Wt.
	No.	Bore	Stroke			
15	1	8"	10"	420	42" × 50"	2500 lbs.
25	1	10"	14"	340	42" × 59"	6800 lbs.
50	2	10"	14"	340	42" × 76"	8800 lbs.
75	3	10"	14"	340	42" × 93"	10500 lbs.
100	4	10"	14"	340	42" × 110"	13800 lbs.

## DE LA VERGNE MACHINE COMPANY

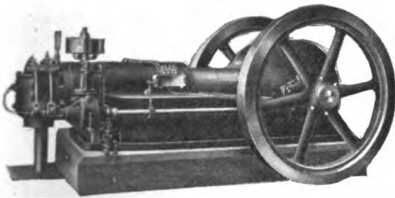
1123 EAST 138TH St., NEW YORK CITY

Manufacturers of Oil Engines for Stationary and Marine Service

Sizes range from 40 to 1440 H. P. per unit. All engines designed to operate on practically any petroleum oil obtainable in the U. S. or Mexico.

### TYPE "DH."

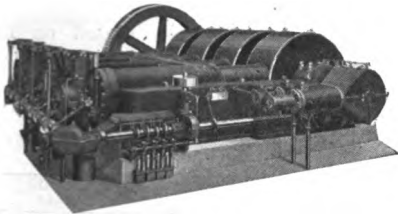
Range of sizes 40 to 200 H. P. This Type an improvement over former and



well-known Hornsby-Akroyd Oil Engine. Operates at slow speeds, on the four-stroke design; in fact, the only four-stroke cycle small Crude Oil Engine of horizontal design obtainable in this country. Engine extremely simple and reliable. Running at rated capacities requires less than .55 lb. of oil per B. H. P. hour. Logical prime mover for small Pipe Line Pumping units and auxiliaries—Municipal Power Plants and small Isolated Industrial Plants of all kinds where petroleum oil is readily procurable.

### TYPE "FH."

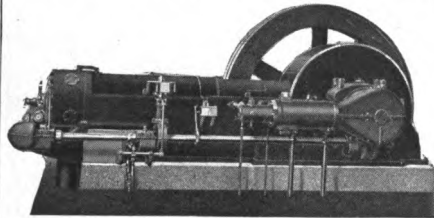
Range of sizes 100 to 600 H. P. per unit, in horizontal cylinder arrangement of one to four. Operates at low speeds. Employs medium com-



pression and functions on the four-stroke cycle. Wide and long experience of many users conclusively proves this Engine best Oil Engine for operation on Mexican or other crude oils having a high percentage asphaltic base. This is due to use of carefully designed combustion chamber, atomizer and correct compression. Engine suited for Pipe Line Pumping units, Electric Generator sets in Lighting and Power Plants, Irrigation service and Industrial drives. It is simple and extremely reliable and hence pre-eminently well suited for production of power at a low cost where petroleum oil is readily procurable. Takes less than .5 lb. per B. H. P. hour when engine loaded near rating.

### DE LA VERGNE-DIESEL:

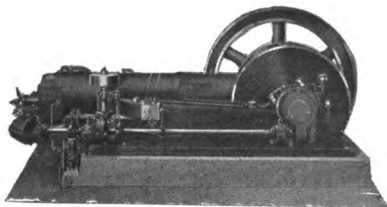
Range of sizes 180 and up in horizontal cylinder arrangements of one to four. Operates at low speeds and obtains extremely high fuel economy. Engine runs on the four-stroke cycle. This



Engine is direct result of an Oil Engine manufacturing experience of over 25 years, and as in the case of the before-mentioned Engines, particular attention has been paid in its development to such design features as lead to great simplicity of all parts. Engine extremely reliable, durable and economical. Logical prime mover for the larger Power Plants where the Oil Engine is applicable.

### TYPE "SI."

The latest development offered for stationary practice in horizontal cylinder arrangements and for marine practice in vertical cylinder arrangements of 3, 4, 6 and 8 cylinders per unit. Will operate



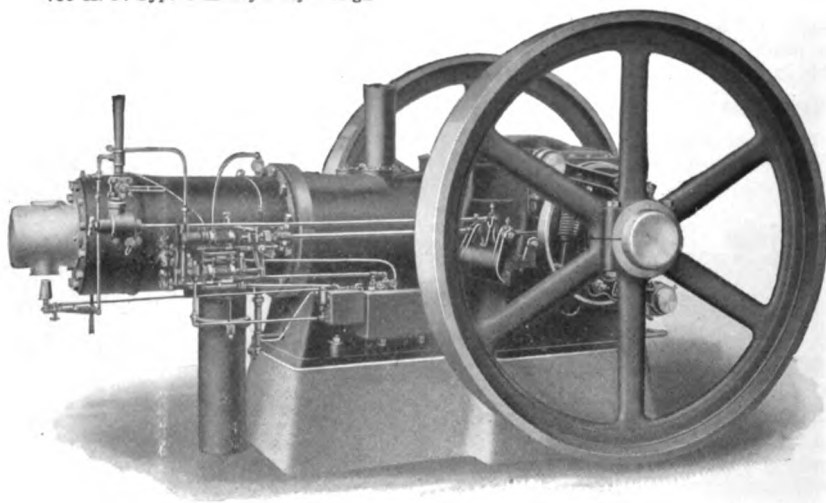
on wide range of petroleum oils. Engine obtains Diesel economy without use of air compressor and attendant mechanism or needle spray valve. This has eliminated many parts and furthered production of engine of maximum simplicity. The Marine Engine is direct reversible. All Engines this type may be started from stone cold and put under load in fraction of a minute. Operating at rating capacities these Engines will produce power at .41 lb. per B. P. H. Hour.

Send for Bulletins.

## MUNCIE OIL ENGINE COMPANY

500 AMERICAN BLVD., MUNCIE, INDIANA, U. S. A.

100 H. P. Type C Heavy Duty Design



34

### THE MUNCIE OIL ENGINE:

Single Cylinder Heavy Duty Crude and Fuel Oil Engines. Medium Compression Low Speed. Sizes 10 to 125 H. P.

Automatic Governor regulation for intermittent loads within two percent ideal where steadiness is desired on changing loads.

Standard Belted with Friction Clutch Pulley Standard Direct Coupled with Friction Cut-off Coupling and Special Electric Types.

Use 24° to 28° Baumé Gravity Fuel Oils ideally or other oils from kerosene or gas oil to 18° Crude. The Fuel Consumption .60 pound per B. H. P. makes them very economical in service.

The complete line of sizes are rigidly constructed to withstand the most severe service. Over 40,000 H. P. in use.

Special Bulletins are issued on the various types and sizes. Write for Catalogue No. 23.

### GENERAL SPECIFICATIONS

H. P.	Speed R. P. M.	Clutch Pulley	Floor Space	Shipping Weight
10	375	20"x 6"	6'- 6"x 5'-0"	2700
20	250	16"x12"	7'-11"x 8'-3"	5600
25	250	22"x12"	8'-11"x 9'-6"	8050
30	250	24"x12"	9'- 3"x 9'-6"	9000
35	250	28"x12"	9'- 3"x 9'-6"	9500
40	265	32"x12"	10'- 9"x12'-0"	14000
45	250	34"x12"	10'-10"x12'-0"	15000
50	250	36"x12"	10'-10"x12'-0"	16000
55	250	38"x12"	11'- 4"x12'-0"	17000
60	240	42"x12"	11'- 4"x12'-0"	18000
70	225	48"x14"	12'- 3"x12'-6"	22000
80	200	60"x14"	13'- 3"x13'-0"	26000
85	200	64"x14"	13'- 3"x13'-0"	27500
100	190	72"x16"	14'- 7"x15'-8"	32500
125	190	76"x18"	14'- 7"x15'-8"	36000

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## WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

SNOW-HOLLY WORKS: BUFFALO, N. Y.

**Snow Oil Engines**

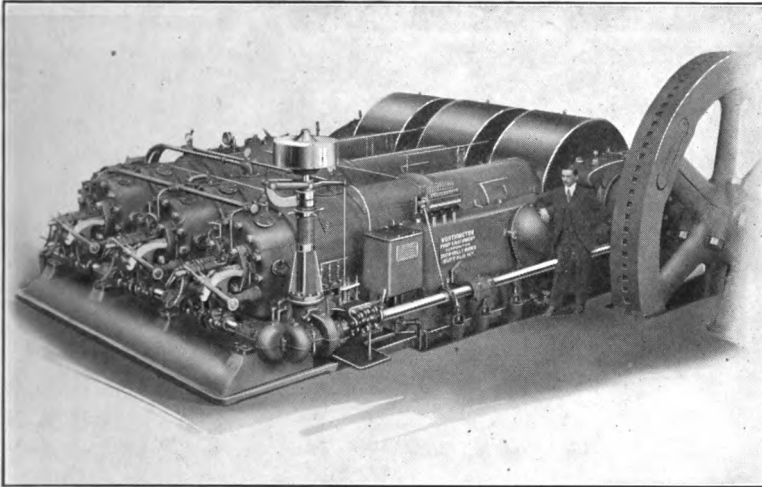
**Snow Gas Engines**

Branch Offices in All Principal Cities

**Snow Oil Line Pumps**

**Snow Gas Compressors**

---



35

### THE SNOW OIL ENGINE—A SELF-CONTAINED POWER PLANT:

The Snow oil engine is of the four-cycle, single, twin or three cylinder type and operates on the high compression cycle. On account of this latter feature there is no sudden rise in pressure with the result that the wear due to shock is eliminated. The temperature of the compressed air is sufficient to ignite the fuel so that a hot bulb or ignition apparatus of any kind is not required.

We have developed a spray nozzle or atomizer which completely converts into fine spray the heaviest grades of asphalt base crude oils and residuums from the Mexico and California fields as well as the lighter fuel oils and distillates from the eastern and mid-continent fields.

Snow oil engines are simple, reliable,

and can be depended upon for continuous service. In their design particular attention is given to accessibility and the reduction of operating attention to a minimum. They are rated conservatively and are subjected to a rigid brake test on our erecting floor before shipment. They are adapted to all power purposes, including belting to generators or line shafts, direct connection to generators for parallel operation, and direct connection to oil line pumps, air compressors or ammonia compressors.

Our standard fuel guarantees, based on crude oil, distillate, or fuel oil of 18,500 B. T. U.'s per pound containing not over 1% of water, are as follows:

.48 lb. per B. H. P. hour at full load.

.50 lb. per B. H. P. hour at  $\frac{3}{4}$  load.

.57 lb. per B. H. P. hour at  $\frac{1}{2}$  load.

Ask for further detailed information.

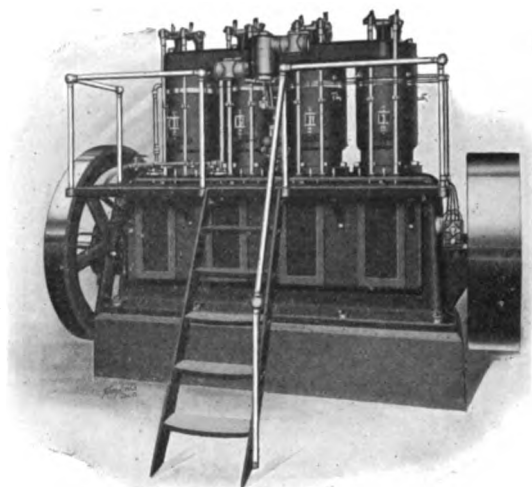
# HOPE ENGINEERING & SUPPLY CO.

TULSA, OKLA.

MT. VERNON, O.

PITTSBURGH, PA.

Consulting and Contracting Engineers in Natural Gas and Petroleum  
Laboratory and Field Tests—Reports



36

## BUILDERS OF REEVES VERTICAL GAS ENGINES:

Any Power up to 200 H. P., Natural, Artificial & Producer Gas.

Manufacturers of:

HAMMON PIPE COUPLER for Oil, Natural Gas, and Water Lines in any Service.

HEAT EXCHANGERS for Treatment of Oil and Gas in Refineries, By-Product Coke Plants, Etc.

ABSORBERS for Gasoline Absorption Plants, Chemical Works, Etc.

*Correspondence Solicited.*

DATA AND LIST PRICE OF REEVES VERTICAL GAS ENGINES

H. P. Nat. Gas	Cylinder			R. P. M.	Shipping Weight	Floor Space	Standard Pulley	List Price
	No.	Div.	Stroke					
18	1	9½	11½	300	5800	48x54	24x 8	1680
40	2	9½	11	300	9000	72x58	30x10	2590
60	3	9½	11	300	12500	88x58	36x12	3270
80	4	9½	11	300	17000	104x58	36x14	4290
100	3	11½	13	275	20000	106x76	54x14	5020
135	4	11½	13	275	26000	126x76	54x19	8170
150	4	12½	13	275	28000	128x16		6776
170	4	12½	14	275	36000	144x80	Special	8476
200	4	14	14	275	40000	148x80		9925

# NATIONAL METER COMPANY

Established 1870

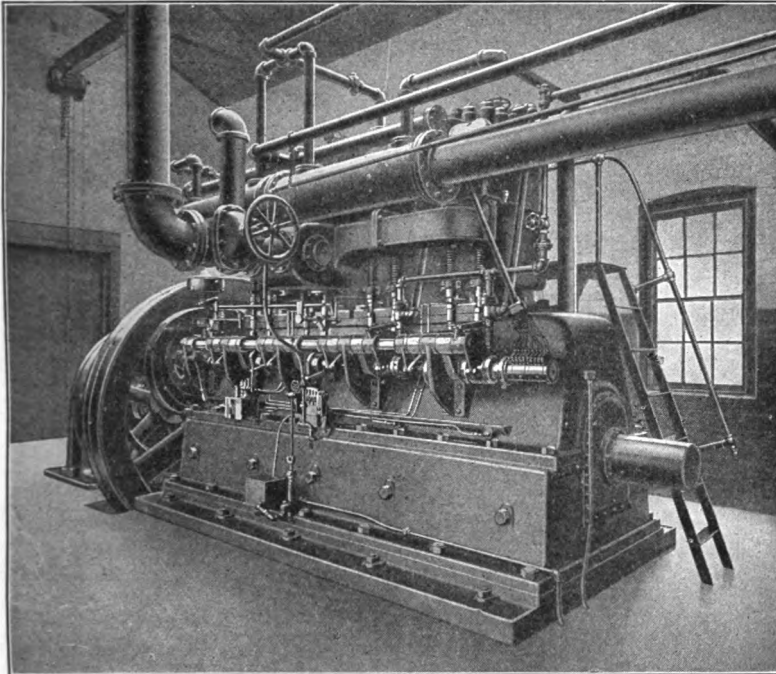
299 BROADWAY

NEW YORK CITY

**Manufacturers of Water Meters and Gas Engines**

**BRANCH OFFICES:**

CHICAGO, 2626 So. Park Ave.    BOSTON, 159 Franklin St.    CINCINNATI, 224 East 4th St.  
PITTSBURGH, 4 Smithfield St.    ATLANTA, 200 Ivy St.    SAN FRANCISCO, 141 New Montgomery St.  
WINNIPEG, MANITOBA, 111 Ethelbert St.    LONDON, 25 Victoria St.



37

**NASH GAS ENGINES:**

**Operate on Illuminating Gas, Natural Gas, Gasoline or Producer Gas. Simple, Silent and Efficient.**

The engine throughout is the embodiment of the latest and best ideas of gas engine design and construction.

Is of very liberal proportions and high grade in every detail. The NASH has many exclusive and valuable features.

All sizes of NASH engines are of the four-cycle type and are fitted with throttling or hit-and-miss governors as may be selected or best suited to the conditions.

The National Meter Company is the originator of the throttling governor for gas engines and the NASH was the first gas engine to be equipped with it.

In regulation, the NASH Gas Engine is on a parity with that of the best steam engines.

Due to its high economy, closeness of regulation and quietness of operation it meets a great range of power requirements.

Manufactured in all sizes from 25 to 400 H. P.



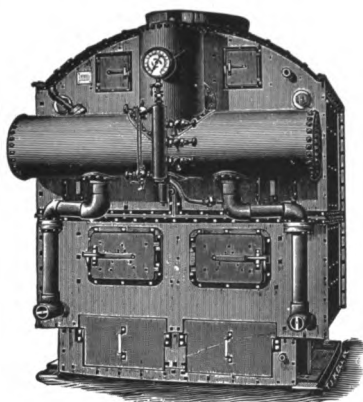
## ALMY WATER TUBE BOILER CO.

PROVIDENCE, R. I.

Sectional Water Tube Boilers for Every Marine Purpose

### ALMY PATENT SECTIONAL WATER TUBE BOILERS:

The Almy Boiler is in every respect a Pipe Boiler, being constructed of Extra Strong Iron Pipe and Malleable Iron Fittings. As the threads are standard size, repairs may be made conveniently in almost any part of the world. Due to design, expansion and contraction is entirely taken care of and sudden change of temperature has no bad effect on the heating surface. 75 lbs. to 100 lbs. of  
**38** steam may be raised from cold water within seven minutes with perfect safety.



Exterior—Class B, C, D

We build six classes or types of boilers—A, B, C, D, E and Z. Type is determined according to the desired duty. Sizes run from 2.7 to 56 sq. ft. of grate surface and 87 to 2,000 sq. ft. of heating surface.



Interior  
Class A, B, C



Exterior  
Class A

An evaporation of 11.92 lbs. of water from and at 212° per pound of combustible has been shown on a 45 H. P. boiler—rate of combustion 14 lbs. per square foot of grate surface per hour. The same boiler under forced draft evaporated 7.89 lbs. of water per pound of coal—gage pressure 153 lbs., feed temperature 56°, rate of combustion 35.98 lbs. of coal per square foot of grate surface per hour.

The large amount of fire-box heating surface receiving direct heat is an important feature. In our Class D and E boilers, there is 90% more of such heating surface than in a flat-sided fire box of equal dimensions.

These boilers are very satisfactory with oil burners as quite a number of installations on the Pacific Coast have proved.

Our business is principally marine but we occasionally furnish boilers for stationary use. "Knocked down" boilers may be shipped in 400 lb. packages and under.

*Catalogue containing full description of construction will be sent on application.*



## BASS FOUNDRY & MACHINE CO.

Established 1853

FORT WAYNE, IND.

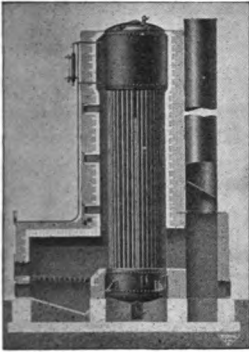
**Manufacturers of Engines, Boilers, Heaters, Steel Plate Work, Rope Wheel Drives, Forgings, Car Wheels and Castings**

### HEAVY DUTY AND GIRDER FRAME CORLISS ENGINES:

For Factory, Rolling Mill and Direct  
Connected Service.

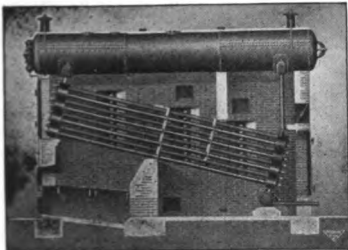


Built in simple, tandem compound and  
cross compound types.



### HORIZONTAL AND VERTICAL WATER TUBE BOILERS:

In sizes from 50 to 1000 H. P.

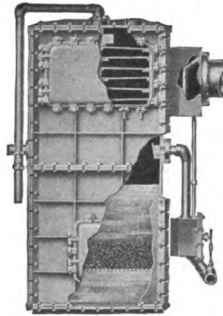


### HORIZONTAL TUBULAR BOILERS:



### OPEN FEED WATER HEATERS:

Both Horizontal and Vertical.



39

Either cast iron or steel construction.  
Built in all sizes.

SEND FOR A COPY OF

"STEAM POWER"

Which illustrates the different types of  
Engines, Boilers, Heaters and other  
power plant equipment which we manu-  
facture.

---

# THE BABCOCK & WILCOX CO.

GENERAL OFFICES:

85 LIBERTY STREET, NEW YORK

**Water Tube Steam Boilers, Steam Superheaters, Mechanical Stokers**

BOSTON, 49 Federal St.

PHILADELPHIA, North American Bldg.

PITTSBURGH, Farmers Deposit Bank Bldg.

CLEVELAND, New Guardian Bldg.

CINCINNATI, Traction Bldg.

ATLANTA, Candler Bldg.

NEW ORLEANS, 533 Baronne St.

HOUSTON, TEX., Southern Pacific Bldg.

TUSCON, ARIZ., Santa Rita Hotel Bldg.

CHICAGO, Marquette Bldg.

DENVER, 435 Seventeenth St.

SALT LAKE CITY, 705-6 Kearns Bldg.

SEATTLE, Mutual Life Bldg.

SAN FRANCISCO, Sheldon Bldg.

LOS ANGELES, I. N. Van Nuys Bldg.

HAVANA, CUBA, Calle de Aguiar 104.

SAN JUAN, PORTO RICO, Royal Bank Bldg.

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## WATER TUBE STEAM BOILERS:

**Babcock & Wilcox**

**Babcock & Wilcox Marine**

**Stirling**

**Rust**

40

Boiler practice has changed materially in the past ten years. Higher pressures and higher superheat have come into every-day practice and with these changes have also come larger units and higher rates of combustion, due to better stokers and furnace arrangement, better methods of feed water treatment, improved coal and ash handling apparatus and a better understanding of the care and operation of boilers. During this period great improvements have been made in the utilization of other fuels than coal. These developments have brought about a change in boiler room design and

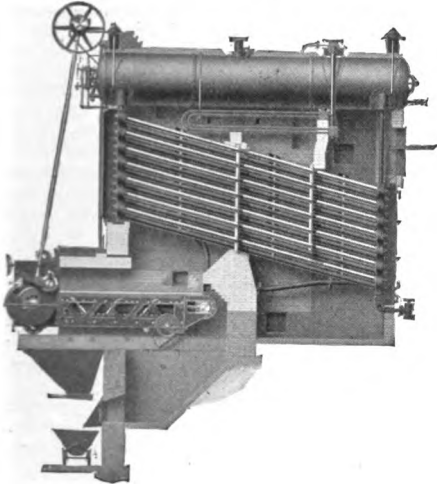
necessitate a much more careful study of the size of plant, service conditions, fuel, water, and class of boiler room help available.

By reason of the different factors involved the selection of a proper boiler unit is much more complex than in the past. Years ago this Company manufactured a line of so-called "standard" boilers; while these standards are still in existence, the sale of a standard boiler today is a rarity, for the reason that operating conditions cannot be even approximately standardized. Each and every prospective boiler sale is approached by this Company as an entirely new and independent engineering problem, the various factors involved determining the particular type, size and setting of boiler offered.

A very brief description of the different types of boilers manufactured by this Company is given on the following pages.

# THE BABCOCK & WILCOX CO.

## THE BABCOCK & WILCOX BOILER:



The heating surface of the boiler is made up of drums extending longitudinally over the other pressure parts. To the drums there are connected, through forged-steel cross boxes at either end, the sections made up of headers and tubes. At the lower end of the sections there is a mud drum extending entirely across the boiler and connected to all of the sections. The connections between all parts are made by short lengths of tubes expanded into bored seats.

The headers into which the tubes are expanded are of forged steel and are of serpentine or sinuous form so that the tubes are disposed in a staggered position when assembled as a complete boiler. This staggering of the tubes breaks up the gases and causes them to impinge on every tube.

Opposite each tube end in the headers there is placed a handhole of sufficient size to permit the inspection, cleaning or renewal of a tube. These handholes are closed by suitable handhole fittings.

The gases of combustion are caused to make three passes over the heating surfaces by baffles constructed of special baffle brick and cast-iron flame plates.

The form of the furnace is such that it is readily adaptable to the fuel available, whether solid, liquid or gaseous.

Boilers are suspended front and rear from

wrought-steel supporting frames, entirely independent of the brickwork.

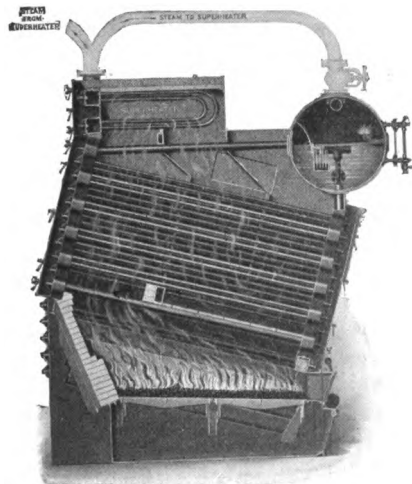
Patented dusting doors furnish a means of keeping all portions of the heating surfaces free from soot and dust. Large doors in the sides of the setting give full access to all parts for inspection and for the removal of any accumulation of soot.

## THE BABCOCK & WILCOX MARINE BOILER:

The Marine Type of Babcock & Wilcox boiler preserves the excellent features of the Land Type but adapts them to the conditions on shipboard. The tubes are usually of smaller diameter and are shorter than in the Land Type. The furnace increases in volume toward its exit and with its tile roof gives highly efficient combustion. The flame plates or baffles and the staggering of the tubes give the heating surface an efficiency unobtainable in any other boiler.

All parts subject to pressure are made of the highest quality of forged steel. No castings are used. The parts are as thick or thicker than the corresponding parts in cylindrical or Scotch boilers. The weight of the boiler, however, is less than one-half that of Scotch marine boilers for pressures above 200 pounds. There are Babcock & Wilcox marine boilers which have

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been in service for more than fifteen years which are still using the original tubes.

The Babcock & Wilcox marine boiler is especially adapted to the use of oil fuel. Where oil is burned, practically the entire surface of the furnace is composed of firebrick, insuring perfect combustion.

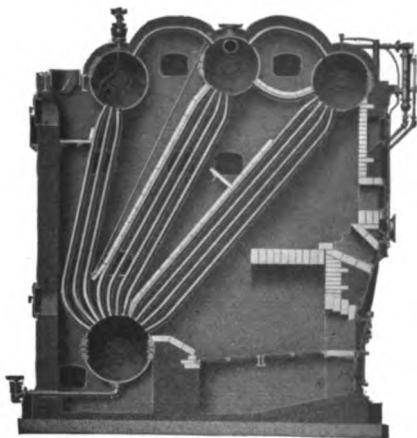
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(Continued from preceding pages)

## THE BABCOCK & WILCOX CO.

85 LIBERTY STREET, NEW YORK

### THE STIRLING BOILER:



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The Stirling boiler consists of three transverse steam and water drums set parallel and connected to a mud drum by three banks of water tubes so curved as to enter the drums radially. The steam space of the center drum, from which steam is taken, is connected to the front and rear drum by steam circulating tubes and to the front drum by water circulating tubes.

The tubes are so spaced as to allow the removal of any tube without disturbing any other tube or the brickwork.

The furnace is formed by the use of a firebrick arch sprung across the boiler setting in the triangular space formed by the front wall and the front bank of tubes. This furnace readily lends itself to the installation of any stoker and the burning of any class of fuel

The gases of combustion are led from the furnace over the heating surface by two baffles of firebrick tile, one resting on the rear row of tubes of the front bank and the other supported on the rear row of tubes of the second bank.

The boiler is supported on a wrought iron framework entirely independent of the brickwork setting.

Large cleaning doors in the sides of the setting give ready access to all portions for cleaning, inspection and repair.

### THE RUST BOILER:

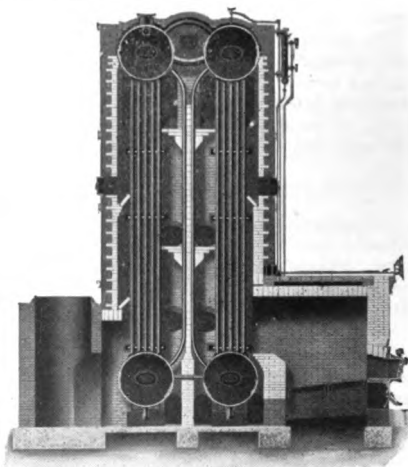
The Rust boiler is made up of two transverse steam and water drums and two transverse mud drums connected by banks of tubes. Each steam drum is connected to the mud drum directly below it by five rows of straight tubes and one row of curved tubes. The steam drums are connected by curved steam and water circulating tubes and the mud drums by water circulating tubes.

The tube sheets of all drums are pressed to form individual tube seats, thus permitting straight tubes to be expanded directly into the cylindrical drums. This construction is patented.

The tubes are staggered and are so arranged that any tube may be removed without disturbing any other tube or the boiler brickwork.

The furnace is of the extension or Dutch oven type and being distinct from the boiler setting proper, enables any type of furnace or any fuel to be used.

The gases are caused to make two passes over the heating surface by a vertical firebrick baffle built between and held in position by the central curved tubes. Horizontal baffle shelves cause all portions of the heating surface to be swept by the gases.



The boiler is supported entirely free of the brickwork on cast-iron saddles under the mud drums, the saddles resting on masonry foundations.

## THE BABCOCK & WILCOX CO.

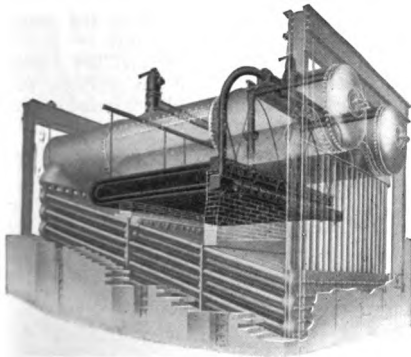
### THE BABCOCK & WILCOX STEAM SUPER-HEATER:

The Babcock & Wilcox superheaters, as built for installation in all boilers of The Babcock & Wilcox Co.'s manufacture, are similar in design, location and operation. The construction is modified in certain details to meet the specific requirements of individual boilers.

The superheater consists of two headers or manifolds, into which tubes bent to a U-shape are expanded. These headers are equipped with handholes and forged-steel handhole fittings, giving access to each tube end. As there is no rigid connection between the headers and because of the proper methods of suspension, there can be no strains set up in the apparatus by contraction or expansion. Each superheater is equipped with an independent steel-bodied, outside-spring, safety valve.

The superheater in all cases is located in the direct path of the products of combustion. The surfaces presented to these gases are smooth, offer the minimum resistance to the passage of the gases and the least opportunity for the adhesion of dust.

Steam is taken from the steam space of the boiler through the dry pipe, is introduced into the intake header and passes through the super-

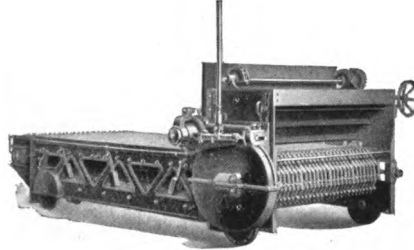


heater tubes to the outlet header, to which the superheated steam connection from the boiler is made.

### THE BABCOCK & WILCOX CHAIN GRATE STOKER:

The Babcock & Wilcox chain grate stoker consists of a grate in the form of an endless chain passing at the front and rear of the boiler furnace over sprockets which are keyed to shafts carried

by the stoker frame. The passage of the grate through the furnace is continuous. The stoker is driven through a worm wheel keyed to the front sprocket shaft. The fuel is fed uniformly to the front end of the grate under an adjustable



stoker gate. The volatile gases are driven off on the forward portion of the grate under an ignition arch and are completely consumed in passing over the incandescent fuel bed before striking the boiler heating surface. Combustion is truly progressive. The ash and refuse are discharged automatically and continuously as the grate turns over the rear sprockets.

The form of the grate links is such as to allow proper admission of air for combustion. Suitable side seals and a bridge wall water box prevent the admission of large quantities of excess air. The bridge wall water box is connected into the water circulation of the boiler and is part of the regular stoker equipment.

The construction of the entire stoker is of such rugged character throughout as to permit continuous operation without the necessity of shut-downs for repair.

This stoker will only be offered for installation where fuel suitable for chain grate stokers is available.

Over 25,000,000 horse power of boilers manufactured by The Babcock & Wilcox Co. are in use throughout the world.

The Babcock & Wilcox Co. publishes the following books: "Steam," "Marine Steam," "The Stirling Water Tube Boiler," "The Rust Water Tube Boiler," "Steam Superheaters," and "Chain Grate Stokers," any of which may be obtained upon application to the nearest of the Company's branch offices.



## BADENHAUSEN CO.

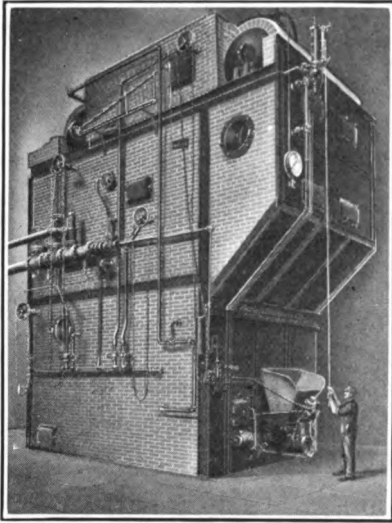
MAIN OFFICE: 1425 CHESTNUT ST., PHILADELPHIA, PA.

WORKS: Cornwells, Philadelphia, on P. R. R. & Delaware River; Bound Brook, N. J.

NEW YORK PITTSBURGH CHICAGO DENVER SAN FRANCISCO  
111 Broadway 311 Jenkins Bldg. 1225 Marquette Bldg. 211 Tramway Bldg. 411 Rialto Bldg.

**Manufacturers of Badenhause Land and Marine Water Tube Boilers and Superheaters; American-Ball Angle-Compound, Duplex-Compound and Simple Engines, Triple Expansion 4-Cylinder Dredge Engine; Variable Speed Engine for Paper Mills, Scotch Marine Boilers; Marine Engines**

44



Badenhause Standard Boiler, Complete Installation

**BADENHAUSEN WATER TUBE BOILERS** have continuous, unrestricted water circulation.

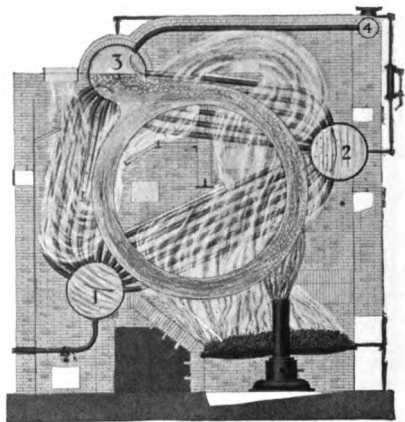
The standard design consists of **four cylindrical drums**, three of equal diameter connected by equal numbers of tubes curved to form a perfect water circulation cycle. This is plainly shown in the above cross-sectional view of the boiler which, for the sake of illustrating this perfect cycle, has superimposed upon it a glass ring filled with water and heated by a lamp. Note how clearly the boiler coincides with the glass ring showing that "The best and soundest circulation theory is carried out practically" in our boiler. Heat is applied and the steam bubbles are rapidly swept from the tube surfaces and as rapidly replaced with more water from the ample supply in the rear tubes and drum 1.

The steam is disengaged from the water in drum 3 and carried through the roof tubes over to drum 4, this drum usually being smaller in diameter than the other

three. It can be seen that the baffling directs the combustion gases to sweep through the front of the boiler and up against these roof tubes where the steam is completely freed of pellets of water and superheated to an average of 10 degrees Fahr. at any rating. The continued sweep of the combustion gases through a downward and then upward path to the exit reduces the furnace temperatures efficiently.

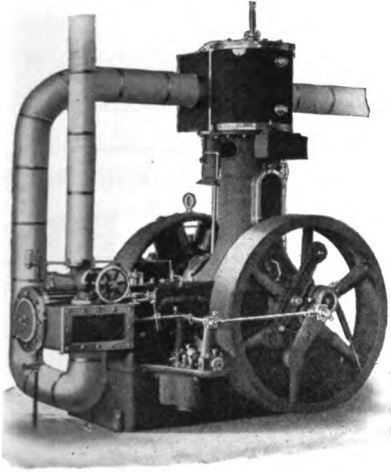
The boiler is supported on steel framing independent of the brickwork. Drum 3 rests on beams, drum 2 is suspended from heavy bolts arranged to accommodate expansion; drum 1 is suspended from the tubes; drum 4 is supported at the ends on steel angles carried up from the main boiler frame. It is evident that the uniformity of the design with such method of support allows each unit of the boiler to expand or contract as temperature changes demand, without detriment to any part. This explains the long life of the Badenhause boiler and the entire absence of leakage throughout.

The continuous, unrestricted water circulation in addition to perfect provision for the inevitable expansion and



Cross-Sectional View Showing Positive, Continuous Unrestricted Water Circulation and Efficient Combustion Gas Travel through Badenhause Boiler

## BADENHAUSEN CO.



**American-Ball Angle-Compound Engine**

contraction of all parts has made possible in this boiler a steaming capacity proven by tests to be limited only by the heat-generating capacity of the furnace.

Easy access for **internal inspection and cleaning** is provided for by simply opening the hinged drum manhole doors. Tubes can then be cleaned by passing through them a turbine cleaner. However, owing to the perfect circulation of the steam and water, it is true that this boiler needs little cleaning or repairing. The tubes are spaced alternately wide and narrow and any part of the boiler can be touched by the hand and any tube can be replaced without disturbing any other tube, such replacement requiring about an hour's work for one man in any part of the boiler.

**Baffles** are of standard tile and can easily be placed.

The Badenhausen High-Efficiency Pre-heater Type of Boiler is our standard design with the addition of an economizing section placed integrally with the boiler proper. This design further reduces the temperature of the escaping gases. Full description of the very high efficiency and overload results obtained on this type of our boiler is given in our Bulletin No. 101 which we shall be glad to send upon request.

Badenhausen boilers are equally desirable for both land and marine service, and are adaptable to any furnace or stoker equipment and for all kinds of fuel combustion.

They now hold the highest steaming efficiency records in land and marine boiler operation.

In plants where high degrees of superheat are desired, the required temperatures can be obtained by installing our Simplex Superheaters.

### **AMERICAN-BALL ENGINES:**

We, having purchased the plant and business of the American Engine & Electric Co., Bound Brook, N. J., are continuing the manufacture of all types of the American Ball Engines heretofore produced, namely, Angle-Compound; Duplex-Compound; Simple, Triple Expansion 4-Cylinder Dredge Engine; the Variable Speed Engine for Paper Mills.

These engines have the general advantages of an automatic system of lubrication, sensitive balanced automatic governor, attached indicator reducing motion.

The special advantages of the Angle-Compound construction with its cylinders at right angles lies in its four impulses per revolution. This gives a nearly uniform torque and makes it especially adapted for driving alternators which are to be run in parallel. Compactness of this design with its practically perfect balance, without noise, vibration or pounding requires only small floor space with light and inexpensive foundations.

The American-Ball 4-Cylinder Variable Speed Paper Mill Engine, an adaptation of the angle compound construction, has a speed range of 8 : 1 and even 10 : 1, permitting of direct connection of the variable speed shaft. It eliminates shutdown to change speed and has excellent speed regulation secured by the special stabilized governor which prevents surging in speed and insures even thickness of paper.

We also build **SCOTCH MARINE BOILERS AND MARINE ENGINES**. Boilers and engines of any required size loaded on board barges or ships at our own wharves.

Our large boiler and engine plant at Cornwells, Pa., is situated on the N. Y. division of the P. R. R. and the Delaware River. The river frontage is being developed to accommodate large steamers up to 10,000 capacity. This plant and our plant at Bound Brook, N. J., equip us to fill orders for any size and number of stationary and marine boilers, superheaters, and engines.

You are invited to call upon any of our sales offices for catalogues, specifications, operation data, prices, etc.

Our engineers solve the hardest steam production problems. Their services are at your disposal.

# THE BIGELOW COMPANY

WORKS AND MAIN OFFICE

76 RIVER ST., NEW HAVEN, CONN.

NEW YORK OFFICE, 85 LIBERTY ST.

BOSTON OFFICE, 141 MILK ST.

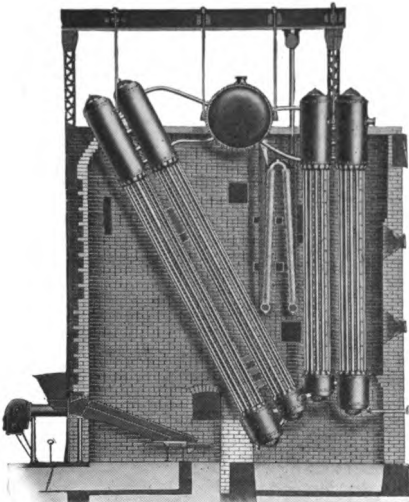
SOUTHEASTERN OFFICE, Realty Building, CHARLOTTE, N. C.

**Manufacturers of Fire Tube and Water Tube Steam Boilers,  
Heavy Plate Steel Work**

## THE BIGELOW-HORNSBY WATER TUBE BOILER:

*Some of the features of the Bigelow-Hornsby Boiler that meet the requirements of Modern Power House Practice:*

- Unlimited size of units.
- Small ground space occupied.
- Coldest water meets the coldest gases.
- All parts, both external and internal, readily accessible.
- All boiler tubes perfectly straight.
- Circulation of water and liberation of steam unrestricted.
- Very dry steam, also ample room for superheaters where required.



Bigelow- Hornsby Boiler

High continuous economy due to extreme cleanliness of the most efficient heating surface.

Arrangement of baffling is such that the gases pass over the heating surface in thin streams and uniformly at every point.

Furnace arrangement is ideal for securing perfect combustion, as furnace is correctly shaped and of ample size.

Greatest flexibility, both as to construction and in steaming qualities.

No cast iron used in any portion of the boiler proper.

Constructed both as to workmanship and material in accordance with the most advanced boiler practice.

## THE BIGELOW-MANNING BOILER:

This type of boiler can be constructed suitable for 200 pounds working pressure. The shell sheets being away from contact with the fire permits the use of any thickness of shell necessary for high pressures.

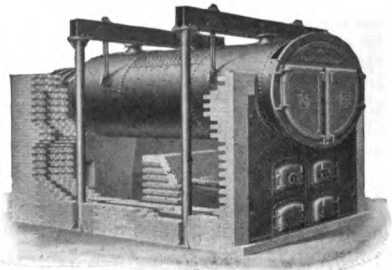
The economical evaporative performance of the Bigelow-Manning Boiler is remarkable. All radiant heat from the fuel bed is absorbed directly by water-heating surface, the distribution of the furnace gases over the heating surface is practically uniform, the superheat furnished is varied by changing the water level, there are no losses due to the infiltration of air in the setting and stand-by losses are comparatively small, occupying per H. P. much less ground space than other types of boilers.



Bigelow-Manning

## RETURN TUBULAR BOILER:

The advantages of compactness and efficiency, large direct heating surface, easy cleaning, large



Suspension Type of H. R. T.

liberating surface, perfect circulation and minimum liability and ease of repairs, are well-known features of this type.

Our boilers are constructed in the most approved manner; we adopt the very highest type of professional and mechanical service, maintain the highest possible standard of efficiency, and believe our facilities for boiler construction are without a parallel.





## R. D. COLE MANUFACTURING CO.

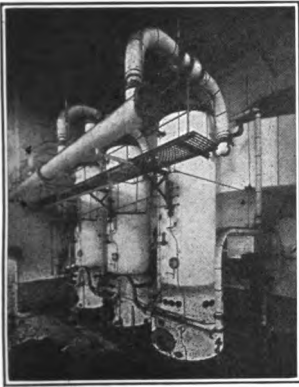
Established 1854

NEWNAN, GEORGIA

Manufacturers of Boilers, Engines, Elevated Tanks, and Steel Plate Work

### COLE-MANNING BOILER:

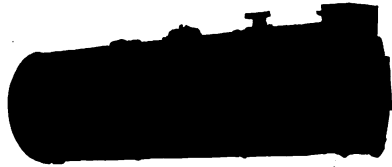
This type boiler is constructed in units up to 400 horse power and for pressure of 200 lbs. or more. Boiler shell is supported on a one-piece cast iron base, which can be fitted with stationary or shaking grates. Smoke box provided with removable cast iron cover and provided with connection for all standard soot-cleaning devices.



The evaporative performance, super-heating qualities and small floor space per horse power, contribute to make this type boiler a most desirable and economical unit.

### HORIZONTAL RETURN TUBULAR BOILER:

These boilers are constructed in a most approved manner and of materials in full accordance with the A. S. M. E. Code. Standard settings can be provided with stationary or shaking grates and where increased efficiency and compactness is desired, standard steel casings can be provided for these settings. These boilers are designed with liberal proportions of heating surface, steam space and grate area, and within the limits of their use-

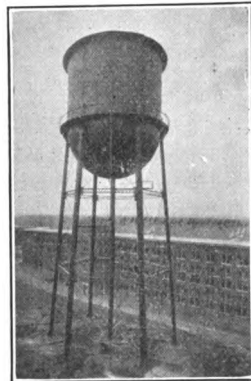


fulness are unsurpassed as steam generators. These boilers are constructed in units up to 250 horse power and for steam pressure of 200 lbs. per square inch.

### ELEVATED STEEL TANKS:

Special designs for steel sprinkler tanks or domestic service will be furnished by our Engineering Department. Our elevated tanks are correct in design and the simplicity of the structure contributes to its low cost of maintenance. Sprinkler tanks and equipment are designed to incorporate the recommendations of all in-

47



insurance authorities. Our facilities provide for the design and construction of all forms of steel plate work, including STACKS, ACID TANKS, PRESSURE VESSELS, STRUCTURAL FRAMES AND TOWERS.



## THE CASEY-HEDGES CO.

Founded 1889

CHATTANOOGA, TENN.

CHICAGO  
MEMPHIS  
DALLAS

NEW ORLEANS  
SEATTLE  
HAVANA, CUBA

NEW YORK  
BIRMINGHAM  
SAN JUAN, P. R.

**Manufacturers of All Types of Boilers and Plate Metal Work**

*Boilers built in accordance with A. S. M. E. Code when desired.*

### C-H HORIZONTAL WATER TUBE BOILERS:

All steel construction. Built in units from 75 to 1000 H. P. Oval handholes with machined surfaces. With either Horizontal, Vertical or Combination Baffles. Large areas through water legs permitting rapid circulation. Boiler supported free from brick work by wrought steel supporting frame at front end; the rear by columns with expansion saddles and rollers.

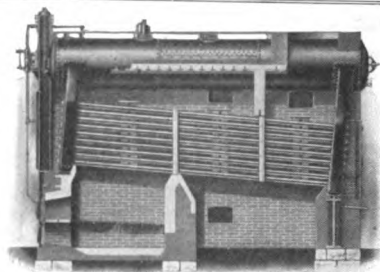
48

### C-H HORIZONTAL WATER TUBE BOILERS WITH STEEL CASED SETTING:

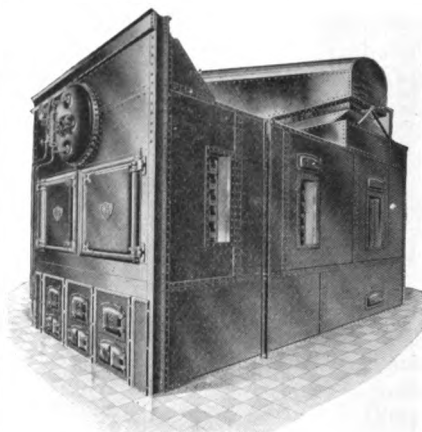
This type of setting entirely overcomes the defects of the brick setting, which consist chiefly of air leaks due to expansion and contraction; also reduces maintenance cost and decreases cost of foundations. Steel casings may be applied to either the Horizontal or Vertical Baffle types. The steel casing may also be used in conjunction with stokers.

### C-H CROSS DRUM WATER TUBE BOILER:

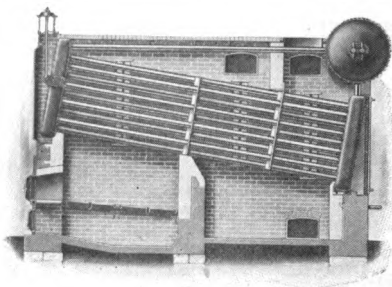
Especially suitable for installations where head room is restricted, such as basements and office buildings. Boiler is of sectional construction; may be shipped knocked down and parts taken through small openings. Built in sizes from 75 to 600 H. P.



C-H Horizontal Water Tube Boiler,  
Vertical Baffle



C-H Horizontal Water Tube Boilers with Steel  
Cased Setting



C-H Cross Drum Water Tube Boiler

## THE CASEY-HEDGES CO.

### C-H VERTICAL WATER TUBE BOILER:

This boiler is of simple construction and very efficient. Consists of one or more upper drums, connected to one or more lower drums by a series of tubes placed in staggered rows. Baffles are set vertically in boiler and may be arranged for either two or three passes of the hot gases through the tube heating surface. Tubes enter drums radially, and are curved to an easy radius. Boiler is of unit construction; therefore, the size is unlimited. Furnace is of Dutch Oven construction.

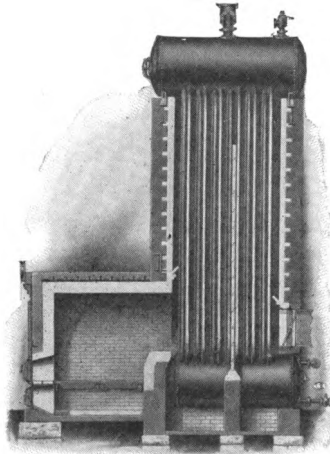
### C-H VERTICAL WATER TUBE BOILER WITH STEEL CASING:

The C-H Vertical Water Tube Boiler is an ideal boiler when steel-encased. A special design of steel casing is used, built in sections. Each section is provided with tie bar lintels that hold the wall in place, preventing buckling or bulging inward of the brick work. It is unnecessary to discuss the value of the steel casing, as it is well known.

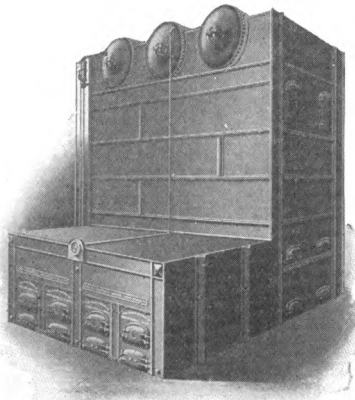
### C-H HORIZONTAL RETURN TUBULAR BOILER WITH STEEL CASING:

We originated the steel cased type of boiler setting, and have perfected three well-known types; viz., Standard, Full Dutch Oven and Semi-Dutch Oven. Steel Casing construction of heavy steel and braced with angles. Will save  $33\frac{1}{8}\%$  in brick work and 60% in foundation. The steel setting is absolutely air-tight; does away with expansion leaks in brick work; has practically no maintenance cost; assembled complete before shipping; may be installed by a novice.

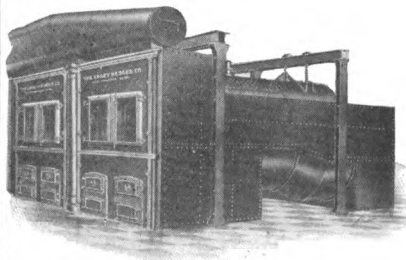
*Catalogue of the Casey-Hedges' Products Will Be Furnished on Application.*



C-H Vertical Water Tube Boiler



C-H Vertical Water Tube Boiler with Steel Casing



C-H Steel Casing for Tubular Boilers

## D. M. DILLON STEAM BOILER WORKS

Established 1870

Incorporated 1908

MAIN OFFICE AND WORKS: FITCHBURG, MASS.

NEW YORK OFFICE  
30 Church Street

SOUTHERN REPRESENTATIVE  
J. S. Cothran, Charlotte, N. C.

**We are Equipped to Furnish:**

### **BOILERS: (A. S. M. E. & Mass. Standard)**

For high pressure service, 150 to 200 lbs. working pressure; all fire tube types such as Horizontal Tubular, Straight Upright, Manning Upright, Locomotive and Marine.

### **STACKS:**

Guyed and Self-Supporting, any diameter and height.

### **TANKS:**

Any capacity, type, pressure or vacuum.

### **ROTARY KIERS:**

Special construction for all classes of  
50 work.

### **KIERS:**

Special construction for any class of work, high or low pressure.

### **VULCANIZERS:**

Special construction for various classes of work.

### **BOILER TUBES:**

All standard sizes; safe ending old tubes a specialty.

### **SMOKE FLUES:**

For any size or type of boiler, any thickness of material.

### **PLATE WORK:**

All kinds.

### **HIGH PRESSURE BOILERS AND LARGE UNITS:**

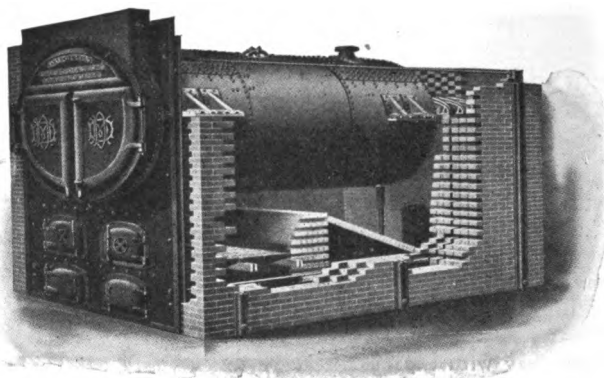
To meet the increasing demand for higher pressures and larger units, we have gone carefully into the matter of thick

shell plates and have found that when used in boilers of proper design and construction, they are perfectly reliable in every way.

We have built many horizontal return tubular boilers for 200 lbs. working pressure using shell plates  $\frac{3}{4}$ " thick, planed down to about  $\frac{1}{2}$ " at the girth seams, and the years of satisfactory service they have given prove that our contention as to the use of thick plates is correct; also that our design and construction methods are the best.

We build horizontal return tubular boilers in units from 10 horse power (24" diam.) to 600 horse power (108" diam.).

Illustration shows all steel boiler



All Steel Horizontal Return Tubular Boiler

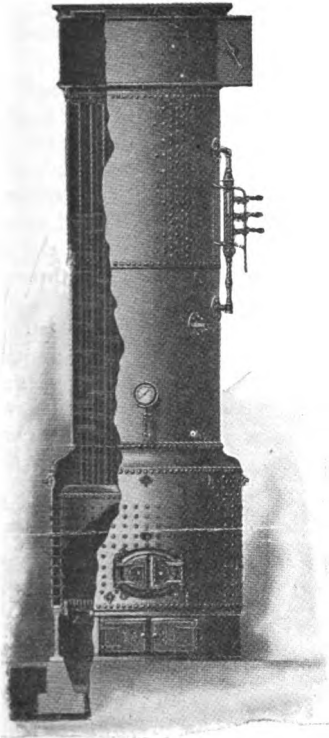
(nozzles, brackets, manhole covers, yokes, etc., all of steel) set with full overhanging steel front of special design. Note the tie rods above and below fire line; also stiffeners to prevent warping.

## D. M. DILLON STEAM BOILER WORKS

FITCHBURG, MASS.

### MANNING BOILERS:

(A. S. M. E. and Mass. Standard)



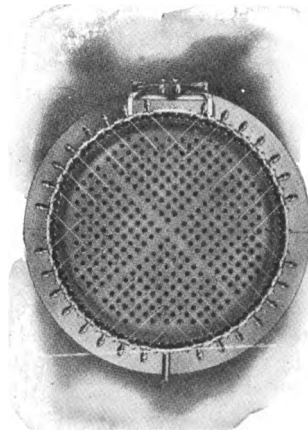
**Manning Boiler, Showing Elevation and Section and Solid Cast Iron Base upon Which It Sets**

The Manning type of upright boiler (see cut) is perfectly adapted to all the requirements of the highest pressures and the largest units, because no plate subject to tensile strain comes in contact with the fire. It is the best boiler for turbines on account of its ability to furnish steam superheated 25 to 50°; the amount of

superheat may be increased by lowering the water line or by using longer tubes.

It is well suited for any locality regardless of water conditions when made with the multiple plan of cleaning handholes which give access to every part of the crown sheet (see cut). The outside furnace plate is sometimes carried a little higher and a 12" x 16" manhole placed opposite the crown sheet, thus providing additional facilities for cleaning and internal inspection.

This boiler being self-contained, requires no brick setting; consequently the expense of maintenance is low, and the efficiency is uniformly high. 51



**Horizontal Section of Manning Boiler, Showing Multiple Plan of Handholes**

We build Manning boilers in sizes from 50 horse power to 500 horse power for any working pressure.

## EDGE MOOR IRON COMPANY

EDGE MOOR, DELAWARE

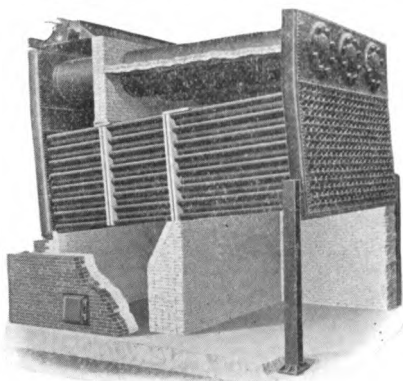
NEW YORK  
111 Broadway

BOSTON  
79 Milk Street

CHICAGO  
10 S. La Salle Street

### Manufacturers of Edge Moor Water Tube Boilers

The Edge Moor Water Tube Boiler is designed for heavy duty under exacting conditions and is built to conform to the best standards. All Edge Moor boilers are constructed in accordance with the A. S. M. E. Boiler Code,



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except when the laws of states or localities where the boilers are to be installed require variations from this code.

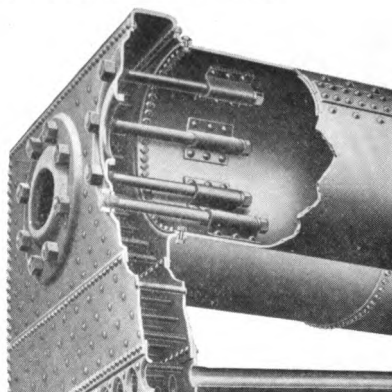
For modern power plants where high pressures are desirable the special features of the Edge Moor design and the careful construction of the boiler produce a sturdy boiler that meets the demands of continuous, hard service. As shown in the above illustration the drums are horizontal, and the tubes are straight. Every tube is accessible through an elliptical handhole in the header plate directly opposite and can be removed through either header.

The illustration opposite indicates clearly the construction of the box headers and the large, unrestricted connection between headers and drums. Each header consists of a tube plate and handhole plate, effectively stayed, and connected together by forged troughs at top, bottom and sides. The headers extend at full width above the top of the drums,

giving additional space for the liberation and storage of steam. The drums are bolted to the headers by a special connection which eliminates the uncertainties of riveting in the field.

Each handhole is fitted with an oval cover which bears against the inside of the header plate and is removable through its own handhole. The edges of handholes are flanged inward for stiffening the plate and are machine-faced to insure a perfect bearing surface for the gaskets. Baffles are vertical and of three-pass or four-pass design.

Edge Moor boilers are custom built. Dimensions for a given horsepower are flexible, and every boiler is designed to produce the maximum efficiency under the operating conditions. All parts subject to pressure are of steel.



### WASTE HEAT BOILERS:

For the utilization of waste gases this company has developed an adaptation of its standard boiler, which contains all of the special Edge Moor features. This boiler is now being successfully operated in steel mills and cement plants, where, installed in accordance with the designs of our engineers, it has proved a commercial success.

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# THE FROST MANUFACTURING CO.

Established 1851

WORKS

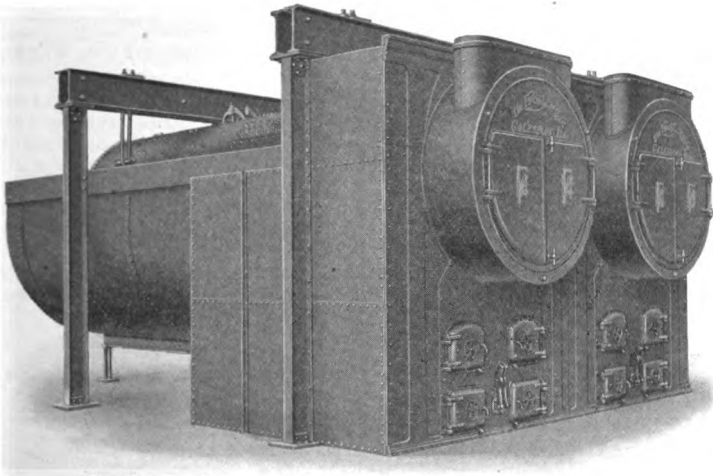
GALESBURG, ILL.

GENERAL SALES OFFICE

112 W. ADAMS ST., CHICAGO, ILL.

**Manufacturers of Steam Engines; Horizontal, Tubular, Vertical, and Fire-Box Boilers; Open and Closed Feed-Water Heaters and Purifiers; Tanks, Air Receivers, Special Plate Work, Etc.**

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***Frost***

## RETURN TUBULAR BOILERS:

Our Horizontal Return Tubular Boilers are built to the requirements of the A. S. M. E. code in sizes up to 84" diameter and for working pressures allowed by the code. All castings are made in our own

foundry insuring the necessary grade of iron for the work. Exceptional drilling and plate planing facilities allow us to build for the highest pressures and the largest diameters.

Our Vertical Boilers are regularly built in sizes up to 60 H. P. and Fire-Box Boilers to 150 H. P.

## HEINE SAFETY BOILER CO.

GENERAL OFFICE, ST. LOUIS, MO.

SHOPS, ST. LOUIS, MO., AND PHOENIXVILLE, PA.

NEW YORK  
PHILADELPHIA

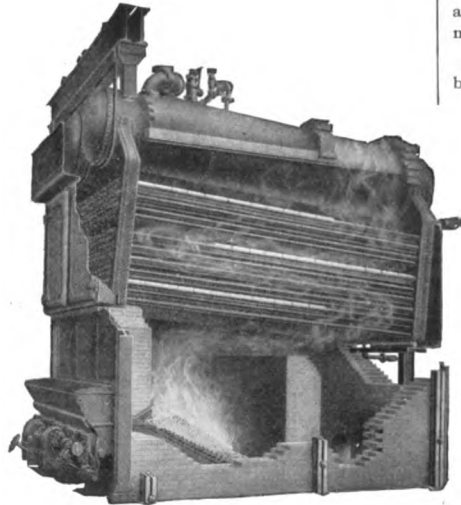
BOSTON  
CINCINNATI  
NEW ORLEANS

PITTSBURGH  
CHICAGO  
DENVER

SAN FRANCISCO  
DALLAS  
CHARLOTTE

**Manufacturers of Heine Standard Longitudinal Drum Boilers, Heine Cross Drum Boilers, Heine Marine Boilers, Heine Steam Superheaters, Steel Stacks, Housings, Flues, Etc.**

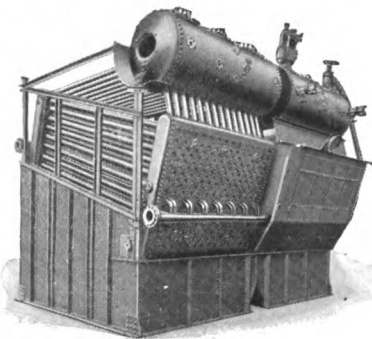
54



### HEINE STANDARD LONGITUDINAL DRUM BOILER:

The combination of baffling placed three rows of tubes from the bottom, and the spacious combustion chamber, gives a highly efficient furnace. As the illustration indicates, the structure is compact—the design is simple. All tubes perfectly straight. Minimum draft. Minimum smoke. Cleanliness is assured because of the permanently installed soot blower.

We would be glad to direct you to comparative tests made by the Bureau of Mines and other



authorities, proving the correctness of the Heine method.

For complete information on this type of boiler, ask for "Boiler Logic."

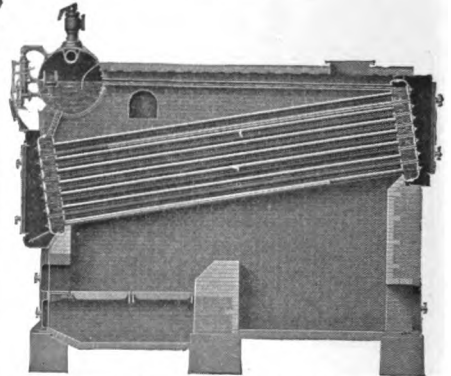
### HEINE STEAM SUPERHEATERS:

If interested in superheaters, write for "Superheater Logic."

### HEINE CROSS DRUM WATER TUBE BOILERS:

This boiler possesses many of the advantages of the Heine Standard Longitudinal Drum Boiler and the additional advantage of small volume for shipment. Note the large combustion chamber, which gives ample time for the gases to mix and burn. The boiler consists of two simple headers, a plain cylindrical drum, and perfectly straight tubes. The design is ideal for free and ample circulation and high efficiency.

Made for hand- or stoker-firing.



Write for literature on the "Heine Cross Drum Boiler."

### HEINE MARINE WATER TUBE BOILER:

We can make these with either longitudinal or cross drums, and with or without superheaters. For Marine Service, however, we recommend the cross drum type.

We built several hundred thousand horsepower of the cross drum type for the U. S. Emergency Fleet Corporation alone.

If interested in Marine Boilers, write for "Marine Boiler Logic."





# E. KEELER COMPANY

Established 1864

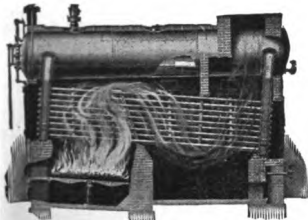
WILLIAMSPORT, PA.

NEW YORK      BOSTON      PHILADELPHIA      PITTSBURGH      CHICAGO      RICHMOND  
TOLEDO      SAN FRANCISCO      PORTLAND, ORE.      CLEVELAND

**Manufacturers of Water Tube and Tubular Boilers. Steel Plate Work**

## KEELER WATER TUBE BOILERS:

**Standard Type:** The arrangement of furnace, tubes, headers and drum in the Keeler Water Tube Boiler is efficient, accessible and compact. The superior efficiency of the Keeler Boiler rests upon correct proportions of heating and grate surface for the character of fuel to be burned, ample height of furnace, a superior arrangement of baffle walls and a perfect circulation. Every portion of the heating surface is accessible for both external and internal inspection, making it impossible for soot or scale to accumulate undetected. There is ample room between tubes and drum for inspection or repairs. Special patented side cleaning doors make it possible to observe the condition of the outside surface of the tubes. There is no part of the interior surface that cannot be examined and cleaned.

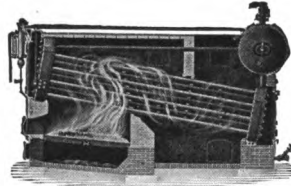


Standard Type Water Tube Boiler

Keeler Water Tube Boilers are usually built complete and tested in the shop. This reduces the cost of erection, as the boilers are handled as a unit. It also eliminates the dangers due to careless assembling of boilers in the field and makes the erection merely a matter of placing in position and attaching fittings.

Built in units 75 to 1500 H. P.

**Cross Drum Type:** The Keeler Cross Drum Water Tube Boiler is a modification of the standard design, only in the length and location of the drum and the method of connecting it to the headers. This type was developed to meet the demand for a high pressure water tube boiler that could be installed in Office Buildings, School Houses, Churches, Apartment Houses, Hotels and boiler rooms generally where ceiling height is limited or where the boiler must be introduced through narrow passageway or restricted openings.



Cross Drum Type Water Tube Boiler

The pressure parts of the boiler are shipped in a knocked-down condition, making it possible to install it without cutting through walls and floors in locations that would be wholly inaccessible for almost any other type of boiler. If boilers are to be exported, the cross drum boiler can be handled at much less expense by steamship companies on account of its reduced bulk in a knocked-down condition, and the comparatively small weight of the heaviest piece.

Built in units 60 to 1000 H. P.

## KEELER HORIZONTAL RETURN TUBULAR BOILERS:

Our return Tubular Boiler is the product of fifty-five years' experience of boiler building. Tube holes are drilled from the solid plate, and not punched small and reamed to size. All seams are thoroughly caulked on the outside, and the end of butt straps are caulked on the inside. Braces are drop-forged. Steam



Horizontal Return Tubular Boiler

and safety valve outlets are provided with wrought steel connections of an approved type. Manhole plates, yokes and brackets are of pressed steel. All boilers built to A. S. M. E. requirements.

**FIFTY-FIVE YEARS OF BOILER BUILDING**

**Ask for Catalogs**

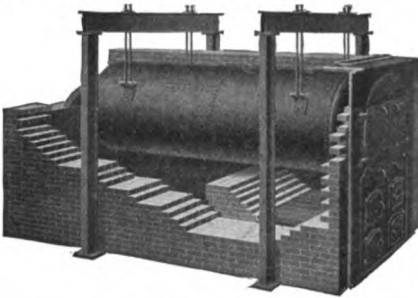
## THE HOUSTON, STANWOOD & GAMBLE COMPANY

CINCINNATI, OHIO

Manufacturers of Steam Engines and Boilers

### HORIZONTAL TUBULAR BOILERS:

We build all sizes of Horizontal Tubular Boilers up to 84"—20'—250 H. P. The 72", 78" and 84" diam. boilers in the 18' and 20' lengths are the most popular sizes and are also most efficient in respect to first cost per H. P. and operating efficiency. We especially recommend The American Society of Mechanical Engineers' Boiler Code to prospective purchasers as the boiler specifications contained therein embody good boiler practice.

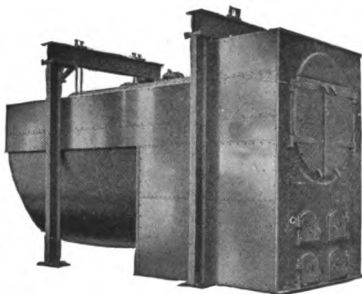


56

Boiler with Full Flush Front and Suspension Apparatus

### STEEL CASINGS:

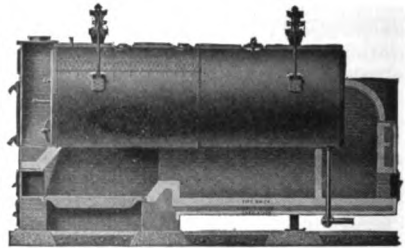
The steel casing boiler setting is a steel jacket for the brick work which secures an improvement in the economical performance of the boiler plant through almost entirely eliminating air leakage through the walls; also greatly reduces the maintenance expense through largely avoiding the necessity of repairs to the brick work, the brick lining being held rigidly in place by the steel jacket.



Steel Casing Boiler Setting with Flush Front

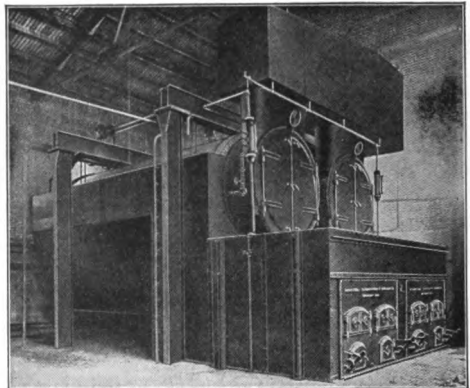
The style of steel casing illustrated is only one of the many designs of steel casings built by us.

The sectional view shows the relation of the brick lining and the insulating lining, the latter being placed immediately inside the steel plates of the casing. Through the use of insulating lining, such as diatomaceous earth, asbestos or other suitable material, the common brick ordinarily employed are almost entirely dispensed with, thus reducing radiation loss, the space occupied, the total weight and the amount of fuel required for raising steam when starting.



Sectional View Steel Casing Setting

Illustration below shows a battery of two boilers having steel casing settings. This installation happens to be equipped with Dutch ovens for burning low-grade, high-volatile bituminous coal.

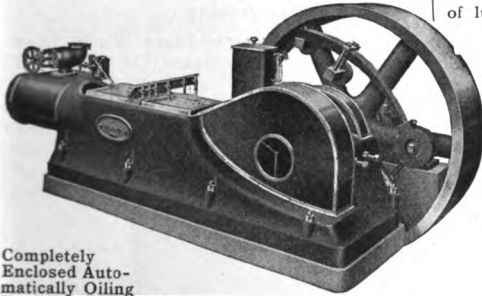


Installation of Two Boilers with Steel Casings

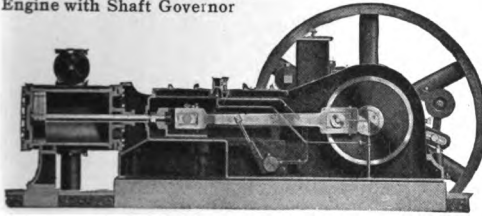
We also build locomotive firebox portable boilers, feed water heaters, smoke-stacks, heavy tanks, stills and do a wide range of similar work.

## THE HOUSTON, STANWOOD & GAMBLE COMPANY

### AUTOMATICALLY OILING ENGINES:

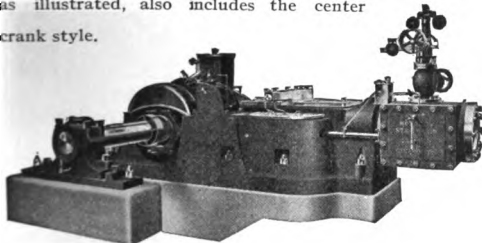


Completely  
Enclosed Auto-  
matically Oiling  
Engine with Shaft Governor



Sectional View

We build completely enclosed Auto-  
matically Oiling Engines with single  
cylinder in sizes up to 300 I. H. P. or in  
twin or cross compound styles, up to  
proportionately larger ratings. It will be  
noted that while all of the moving parts  
are readily accessible, yet even the valve  
gear is enclosed in such a way as to permit  
the bearings of the valve gear to be flooded  
with oil in the same manner as the other  
bearings are lubricated. Our line of en-  
closed engines includes the side crank style  
as illustrated, also includes the center  
crank style.



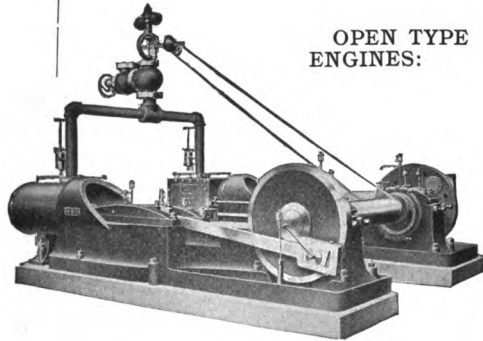
Completely Enclosed, Automatically Oiling  
Engine with Throttling Governor.  
Hand Adjustment for Variable  
Cut-off Is Illustrated

The sectional view will make clear our system  
of lubrication. The lubricating system is so de-  
signed that the piping is completely en-  
closed within the bed plate, so that it  
does not have to be shipped separately  
and attached at destination.

There is a considerable demand for a  
high-grade completely enclosed auto-  
matically oiling engine for direct con-  
nection to rotary pumps, fans, blowers,  
etc. For this class of service it is fre-  
quently preferable to operate the engine  
under control of the throttle or with a  
limit-speed throttling governor. When  
this is the case it is often desirable to  
have a hand adjustment for varying the  
cut-off (illustrated herewith). We also  
similarly equip center crank engines when  
preferred.

### OPEN TYPE ENGINES:

57



Heavy Duty, Open Style Twin Engine with  
Throttling Governor

Open type engines of the side crank  
style are built by us with single cylinder  
with capacities up to 350 H. P. or with  
twin cylinders up to 700 H. P. We build  
open type engines both simple and com-  
pound and equipped with either throttling  
or shaft governors. We build center  
crank open type engines up to about 100  
H. P. The illustration shows a large size  
twin engine of about 500 I. H. P. Such  
attachments as link motion, gearing, hoisting  
drums, etc., are frequently furnished by us.

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## KROESCHELL BROS. CO.

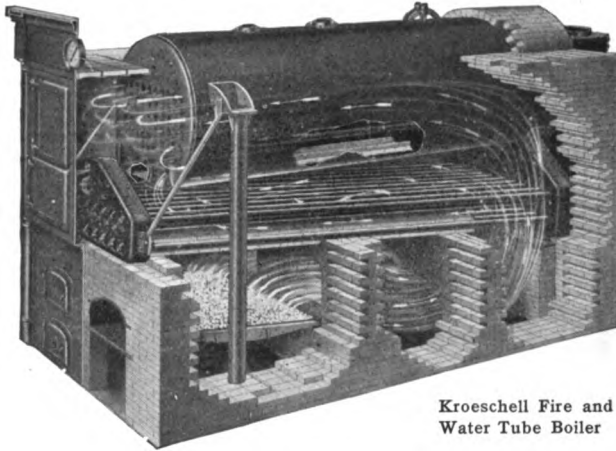
Established 1879

460 WEST ERIE ST., CHICAGO, ILL.

TELEPHONE: Superior 8680—Private Exchange All Departments

**Boiler Manufacturers, Heating and Power Contractors, General Plate Work, Steel Stacks, Breechings, Tanks, Feed Water Heaters, Crucible Furnaces (Oil and Gas), Ideal Chain Wrenches**

---



Kroeschell Fire and  
Water Tube Boiler

58

### THE KROESCHELL FIRE AND WATER TUBE BOILER:

**Patented 1912**

A highly efficient and convenient unit for medium capacities. Built in sizes from 100 to 300 Horse Power.

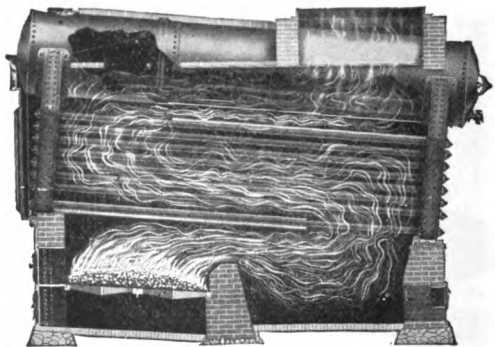
Long Fire Travel, Straight tubes. All parts readily accessible for cleaning and inspection.

Especially designed for large energy storage and rapid steaming to meet requirements of fluctuating loads. Maximum capacity for minimum floor space.

### KROESCHELL WATER TUBE BOILER:

Built for heavy duty service. The excellence of design and construction of this boiler has been demonstrated by nearly forty years of successful operation.

Sizes 100-700 H. P.



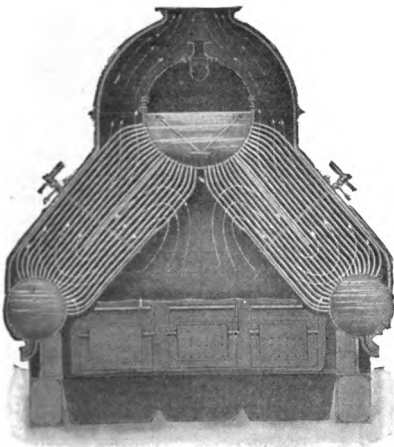
Kroeschell Water Tube Boiler

## NEW YORK ENGINEERING CO.

2 RECTOR ST., NEW YORK CITY

### THE COLVEN MARINE BOILER:

The Colven Boiler is essentially a marine boiler, designed and built for this specific purpose. It embodies all of the special features demanded in this class of work, including the greatest reliability, economy and steaming capacity, within the smallest limited space and weight.



Style "A" Three-drum Type Colven Marine Boiler

### Simplicity:

It will be seen at a glance that the Colven Boiler is simplicity itself—no screw joints; no headers with their numerous handholes and packed or ground joints together with their restricted passages—no straight tubes anchored into immovable ends or headers with no chance for expansion. The Colven Boiler contains no castings; every part is of wrought steel.

Expansion and contraction take place freely in the Colven Boiler without straining any one part.

### Safety:

The Colven Boiler is safest because every part is a true circle. There are no flat surfaces requiring numerous stay bolts and braces. There are no seams or riveted joints exposed to the fire, as they are all outside of the boiler casing, where they can always be observed.

### Space Economy:

The Colven Boiler occupies less space per square foot of heating surface than any other marine boiler.

### Accessibility:

It is a quick steamer, and steam can be raised in less than twenty minutes. The tubes can be cleaned on the inside, if necessary, by the usual methods. All parts of the boiler are accessible, and steam and water drum can be inspected simply by the removal of manhole covers.

### Large Units for Rail Shipment:

The Colven Boiler can be supplied in larger single units than any other type, thus decreasing the number of boilers required. Moreover, this boiler is usually assembled and completed in our shop, and large units, having from 3000 to 4000 square feet of heating surface, can be readily shipped by rail. The Colven Boiler, being shipped in its completely assembled condition, is ready for lowering into the hold of the vessel when it arrives at destination. It is due to this fact that a large amount of time and money is saved. With most other boilers it is necessary that they be shipped knocked down, thus leaving the most important and expensive part of the work to be done in the hold of the vessel. Facilities are provided for attaching the lifting gear to the Colven Boiler so that it may be readily lowered into the hold.

This boiler, owing to its large combustion chamber, is adapted to burning coal, oil or wood, equally as well.

This type of boiler has been used in the United States Navy, and has fully demonstrated all of our claims.

The Colven Boiler is built in two types, namely, the two-drum and the three-drum. It is readily adaptable to the limited conditions usually encountered in marine work, and it can be varied in detail to meet the most exacting requirements.

*Bulletin on application.*

## THE GEORGE T. LADD CO.

GENERAL OFFICES

1620 FARMERS BANK BLDG., PITTSBURGH, PA.

Manufacturers of the Ladd Water Tube Boiler

### WATER TUBE BOILER

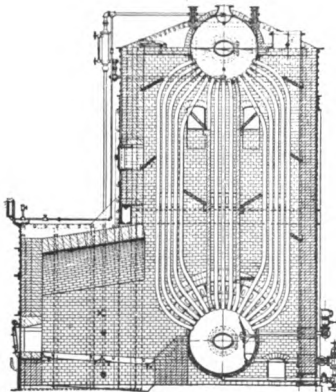
PATENTED (OTHER PATENTS PENDING)

The Ladd Water Tube Boiler is a combination of rugged, simple and accessible construction. It has a clearly defined and unrestricted circulation, properly designed and proportioned gas passages and presents its entire heating surface in an efficient manner to the action of the hot gases. A corollary of the above is economical steam generation, both from the standpoint of upkeep and fuel consumption.

There is but one standard of construction: that of the A. S. M. E. Boiler Code. The drums provide for ample liberation area, and in the smallest boiler admit of ease in rolling of tubes or inspection. The tubes are all bent to a single radius, staggered to the passage of the gases and so arranged that any tube may be removed without disturbing others adjoining. No cast iron parts are used in the construction other than in connection with the brick setting, nor are there any flat or stayed surfaces. Access to the entire boiler is had through swinging manholes in the drums.

The Feed Water is introduced into a separate compartment in the lower drum

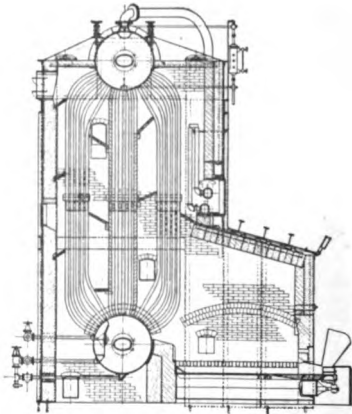
60



Hand Fired Arrangement

and from there conducted upward at low velocity through the rear bank of tubes.

where it is held in contact with the gases in the rear pass for a period of ten to twenty minutes depending on the rate of evaporation. This permits complete



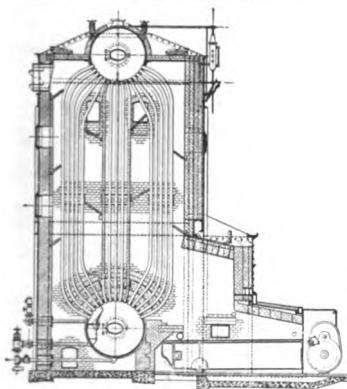
Forced Draft Stoker and Superheater Application  
sedimentation before the incoming water is brought into contact with the hot gases and insures a temperature practically equivalent to that of the steam before the water enters the circulation proper.

The circulation from this point on is positive and unrestricted, being directly down through the middle bank of tubes into the lower drum, thence upward in the front bank. At no point in the system of circulation is the combined cross sectional area of the tubes less at one point than at another.

The boiler is suspended or swung in the furnace from heavy pin connections attached to the top drum which transmit the entire weight of boiler and contents to a structural steel supporting frame. This frame lies outside of and flush with the brick setting and carries, beside the boiler, the superheater, all arch thrusts in the brick-work, the stack, if desired, and is available for the support of coal bunker, piping, walk-



# THE GEORGE T. LADD CO.

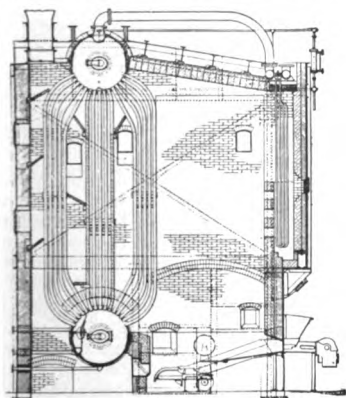


Chain Grate Stoker Application

ways, etc., or whatever is expedient to attach to the supporting frame. In the Dutch Oven type, the entire furnace is steel jacketed, the jacket being integral with the supporting frame. Where stokers are used, they are bolted to and held in place by this frame.

This type of suspension renders the brickwork free from all duty except that of insulation yet confines it so securely as to render it as air-tight as brickwork can be made.

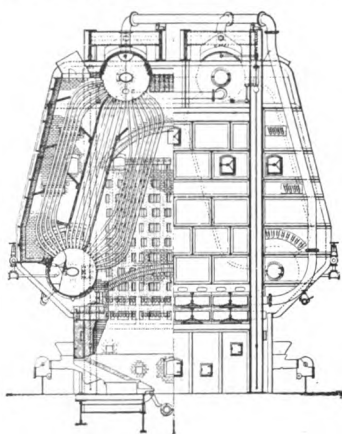
Particular attention has been paid to the **baffling** which has been worked out to most efficiently present the heating surface to the hot gases and at the same time prevent shrouding of the tube surfaces. Renewals are quickly and easily made and with reasonable attention, it is proof against short circuit of gases. It is of fire brick construction throughout, no metal binders or clamps



Heavy Duty—High Arch Type

being used in the high temperature zones and is tight and lasting for long periods. Any number of passes from two to five, inclusive, may be provided. The baffle system is so arranged that it can be inspected and every tile reached by the operator from some point within the boiler.

While it is impossible to standardize boiler **furnace construction** for all conditions and fuels, the furnace of most general interest is probably that for the burning of bituminous coal over forced draft stokers. For such service, if the unit is to be subjected to high overloads, the Ladd Boiler is usually equipped with the high arch type of furnace. This furnace



Multi-Drum Type

promotes complete combustion, utilizes the radiant heat to the best advantage, renders the installation smokeless, and is easiest in the heat action on the tubes of any boiler furnace yet designed.

For very large units, the **Ladd Multi-Drum Type** offers all the furnace advantages of the high arch boiler with the additional feature of extremely small external radiating surfaces. The **superheaters** in this type may be carried in the end walls, thus rendering all four sides of the furnace heating surfaces from a point just above the stoker hoppers. This boiler can be made for either three or five pass gas travel.

In range of size, the Ladd boiler is built from the smallest practical water tube unit up to 1500 H. P. in the single type, and to upward of 4000 H. P. in the Multi-Drum type.

Write for catalog No. 17. List of prominent users furnished upon application.



## MURRAY IRON WORKS CO.

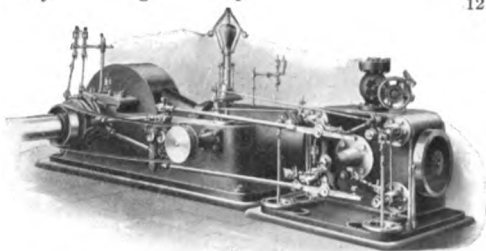
1870

1919

BURLINGTON, IOWA

Complete Power Plants—Corliss Engines—Boilers of All Types—Air Compressors, Pumping Engines, Feed Water Heaters, Rocking Grates

**MURRAY CORLISS ENGINES** are built either with girder frame, tangye frames or rolling mill frames of our patented design. Ask for Catalogue No. 85.



Murray Rolling Mill Type Corliss Engine

The Standard Murray Corliss is a girder frame engine built in sizes up to 18 x 42 inches, and capacities ranging from 50 to 600 H. P.

62

**Murray Tangye Frame Corliss Engines** for extra heavy duty are built in sizes from 16 x 36 inches upward.

Our Rolling Mill Type Frame for high pressures and high speeds is built for engines from 12 x 24 inches upwards. Capacities range from 100 to 1300 H. P. Tandem and Cross Compound Engines are built for any load required.

**Murray Minor Corliss Engines**, 20 to 70 H. P., are suitable for the smaller mills and factories.

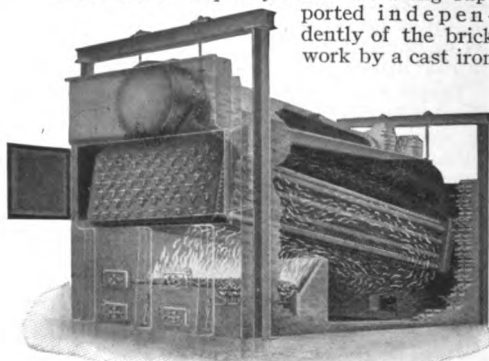
### Points of Superiority:

- A. Excellence of materials.
- B. Best workmanship.
- C. Rigid inspection.
- D. Superiority of design in the following particulars of detail:
  1. The latest and most approved forms of frames, suitable for every purpose.
  2. High speed, ball-bearing governor with improved safety stops.
  3. A form of cylinder whereby the exhaust passages are insulated from the cylinder by a dead air space.
  4. Improved valve motion.
  5. Improved dash pots, under the cylinder plate, or bolted to side of cylinder.
  6. Improved forms of steam and exhaust valves. (Double ported when specified.)
  7. An improved form of piston.
  8. Fly wheels made in halves, free from initial strains.

9. Vertically adjustable outer pillow block with oil-retaining rim.
10. Broad pyramidal main bearing and cylinder feet or sole plates.
11. New and improved style connecting rod.
12. Improved cross head with adjustable shoes running in bored guides.
13. Smallest possible clearance volume.

### HIGH PRESSURE MURRAY BOILERS:

The essential features of the Murray Water Tube Boilers are safety, simplicity, accessibility and economy of fuel and space. They are of the straight tube, all steel type, no cast iron being used in any part subject to tensile strain. They are made up of front and rear headers connected together with wrought circulating tubes and a top steam drum or drums, the whole set with an incline to the rear in an inexpensive brick setting, those of 200 H. P. capacity and over being supported independently of the brick work by a cast iron



Murray Water Tube Boiler with Suspension Rigging

column and steel girder gallows frame as shown.

We do not confine our customers to one type, but build the Tubular, the Water Tube and the Internal Furnace. These different types of boilers are described in the following: Water Tube—Catalogue No. 60; High Pressure Horizontal Tubular—Series "D," No. 4 Pamphlet; Standard Horizontal Tubular—Series "D," No. 6 Pamphlet; "Duplex"—No. 75 Pamphlet; Vertical and Portable—Series "D," No. 10 Pamphlet.



# MURRAY IRON WORKS CO.

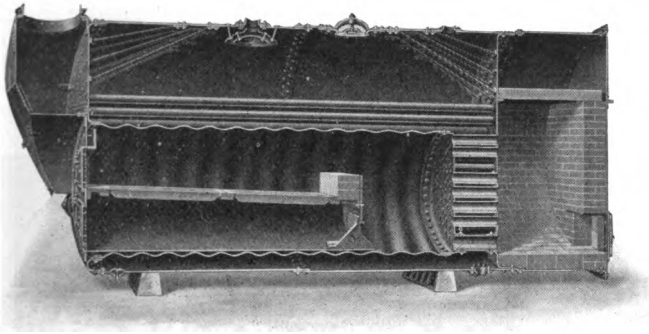


Fig. 1

## MURRAY DUPLEX INTERNALLY FIRED BOILERS:

### A Different Principle of Circulation

The special feature of the Murray "DUPLEX" boiler is covered by letters patent No. 1,151,127 and this improved form of construction can only be used by the Murray Iron Works Company. The "Scotch" boiler as built heretofore, while nearly the ideal boiler for economy of fuel and space, had one decided weakness, namely, poor and unequal circulation. Owing to the location of the flues and the furnace the heat travels as shown in Fig. 2, and the lower part of the boiler is always cold, so cold, in fact, that in many cases you can safely put your bare hand on the bottom of the shell because all the heat of the fire is transmitted to the water in the upper half of the boiler.

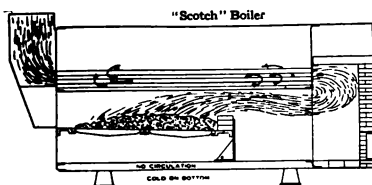


Fig. 2

This unequal heating has two serious drawbacks: first, the water in the lower part of the boiler being dead, only that above the furnace is in circulation, thus materially cutting down the capacity and

efficiency of the boiler; second, the extreme difference in temperature between the top and the lower part of the boiler generally causes it to leak in the girth seam.

Fig. 2 correctly represents the fire travel and water circulation in the ordinary types of "Scotch" boilers.

In the Murray "DUPLEX" boiler the circulation is similar to that in an externally fired boiler. Our boiler becomes hot all over setting up a rapid circulation and overcoming all unequal expansion and contraction in the shell and furnace. You would need an asbestos mitten for safety if you placed your hand anywhere on the bottom of our boiler. Note the difference in circulation between a "Scotch" boiler and the Murray "DUPLEX" boiler as shown by Figs. 2 and 3.

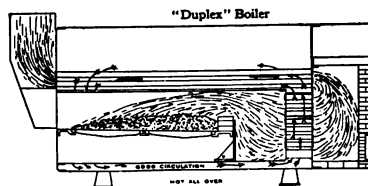


Fig. 3

"DUPLEX" Internally Fired Boilers are built in sizes of 50, 75, 100, 125, 150, 200 and 250 H. P.

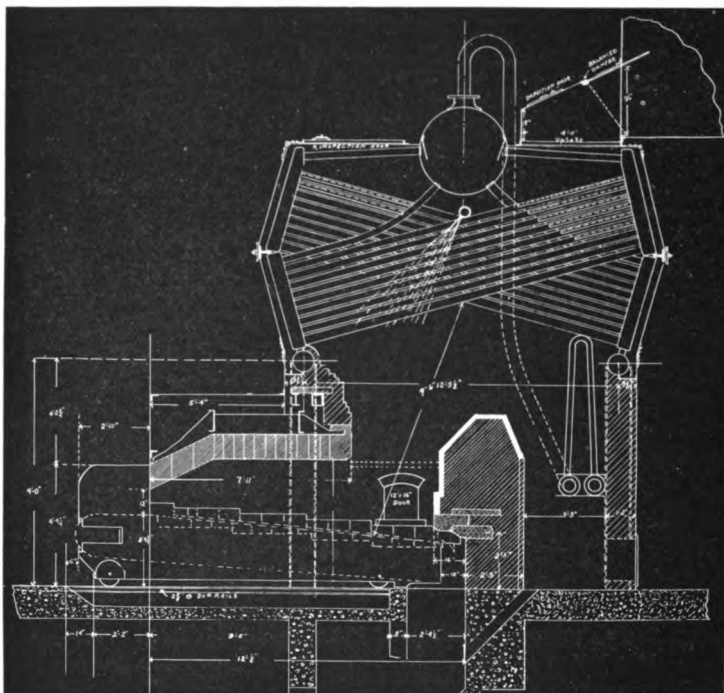
These Boilers Are Practically Smokeless.

## PAGE BOILER COMPANY

GENERAL OFFICES:

815 TO 819 LARRABEE ST., CHICAGO, ILL., U. S. A.

Manufacturers of Water Tube Sectional Steam Boilers



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### PAGE-BURTON WATER TUBE SECTIONAL STEAM BOILERS:

#### SELF-CONTAINED

**Built for Any Space Conditions.  
Largest Power. Small Space.  
Highest Efficiency. Long Life.  
Absolutely Safe.**

The Page-Burton Water Tube Boiler is self-contained. The steel enclosure is lined with air cell asbestos and fire brick. Air leaks are not known in this enclosure.

Boilers adapted to any type furnace—due to its sectional design all material can be delivered into an opening 4 ft. by 4 ft. Largest power, smallest space. No trouble to keep boiler free from sediment inside and soot outside. The Page-Burton Boilers are equipped with our oscillating soot blowers. All sections

blown in one minute, not a door to open.

The large mud drums are truly settling chambers and when properly handled the boilers may be washed out as quickly as a tubular type boiler.

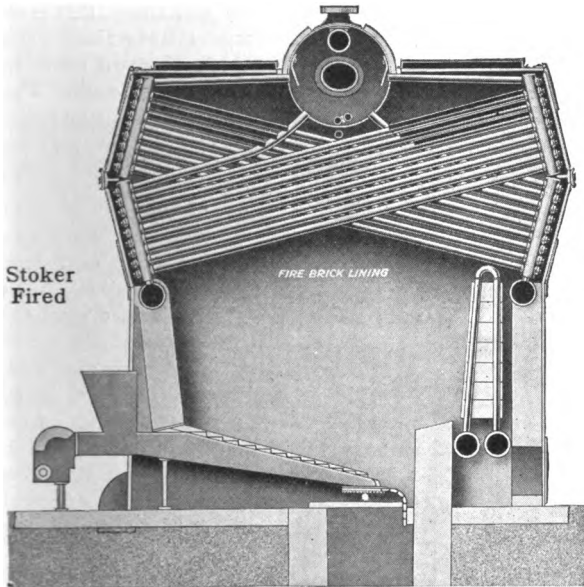
Page-Burton Boiler built for pressure of 140 to 275 lbs. Size units 75 to 1000 H. P.

Send for our new catalog. Patent and patents pending.

Note large combustion area directly beneath the entire tube surface, every inch of water heating surface effective, gases are split up vertically and horizontally. Baffles are at top which causes gases to expand as they pass through the entire tube sections and under the steam drum the best possible efficiency is obtained.

# PAGE BOILER COMPANY

## PAGE-BURTON WATER TUBE BOILER:



Stoker  
Fired

up to 300 H. P. capacity can be reset by simply removing the lower casing.

Boilers up to 500 H. P. can be taken through an opening 4 ft. by 4 ft.; larger sizes require an opening of 4 ft. by 8 ft.

The hand-hole plates are not exposed to the heat; no seams, bolts, braces or rivets are exposed to the hot gases.

Each boiler is equipped with our oscillating efficient soot blower and while in operation there are no doors to open. This is a single-pass boiler having no baffles in the sense in which baffles are ordinarily used.

Three-pass boilers do 80% of their work in the first pass, this boiler does 100% in its one and only pass. Gases are properly distributed over the entire heating surface, and are split up vertically and horizontally, using practically every inch of heating surface all the time.

Steel casing lined with asbestos cell board between casing and tubes and between casing and firebrick.

65

A "Safety" Boiler for high pressure requiring small space—suitable for all. Built for any working pressure up to 200 lbs. standard construction; up to 300 lbs. special construction; same principle in all cases. Changes made only in steel or material in the headers and drums.

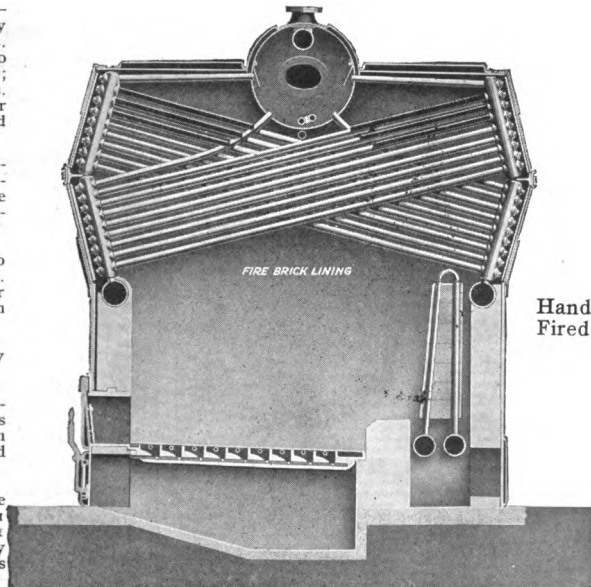
Built to conform with insurance companies' requirements, the A. S. M. E. Code and local inspection requirements.

One steam drum and two mud drums with tube sections. Will raise steam from cold water to boiler pressure of 200 lbs. in thirty minutes.

Completely supported by steel structure and casing.

A large self-cleaning combustion chamber; no bricks used other than the bricks in the combustion chamber and below grates.

Requires about one-third the foundation of the average water tube boiler, a ten or twelve inch concrete floor is usually all that is necessary. Boilers



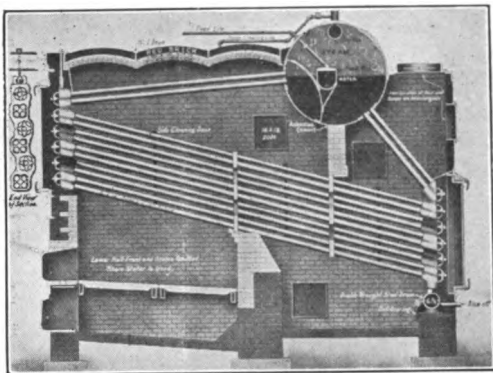
Hand  
Fired

# SPRINGFIELD BOILER CO.

SPRINGFIELD, ILL.

Builders of "Springfield" Boilers

## "SPRINGFIELD" WATER TUBE BOILERS:



Side Elevation

### Sectional-Sinuuous Headers

**NO Staybolts**

66

**NO Braces**

**NO Bent Tubes**

**ALL STEEL Construction**

Illustration shows a complete section of the "Springfield" Water Tube Boiler in place, with the front header suspended and the rear resting on a ball bearing. This construction allows the header to come and go from any direction, relieves it from all strain, and does away with the wear and tear that is sure to follow in a boiler where the joints are rigid. The front headers hang from suspension rods. There are no riveted seams where the header is connected to the drum, as in water-leg boilers.

The 3-inch tubes are placed at an angle of 15 degrees. This gives rapid and perfect circulation. They are in groups of four, with one *hand-hole* to each group. Two-thirds less hand-holes than in other horizontal water tube boilers; this greatly facilitates and lessens cost of cleaning. Hand-holes have *inside steel plates*.



Each section is connected to the steam and water drum by four tubes; this gives very large liberating area, evenly distributed over the entire length of the drum. This insures perfect circulation. Drum of large diameter and special dry pipe insures dry steam.

Baffles are made of cast iron, with open face and cast iron sleeves, through which the tubes pass. They are filled with fire clay and cement, held in place by flame bars, and form a solid wall. They are indestructible. Permit removal of any tube without disturbing other tubes or baffles.

Tubes are staggered in such a way as to allow the gases to completely surround them. This allows a thorough mixture of the gases of combustion.

Boiler is very compact; occupies less space than any other boiler of like capacity and requires less brick for its setting; approximately 97 per cent of the total heating surface is *in the tubes*.

Built in all sizes from 150 H. P. to 2000 H. P. and for any working pressure. **"SPRINGFIELD" INTERNALLY FIRED BOILERS:**

with Corrugated Furnaces, have many valuable features to recommend them both to the Engineer and to the user. They are rapidly becoming adopted everywhere for both power and heating purposes. *Economical* in the use of fuel, floor space occupied, head-room, repairs, and because they are easy to clean.

Write for pamphlets and further data.



TRADE MARK

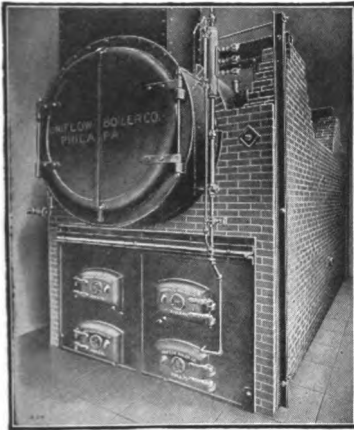
# THE UNIFLOW BOILER CO.

GENERAL OFFICES: PHILADELPHIA, PA.

BOSTON PITTSBURGH MERIDEN, CONN. ROCHESTER CHICAGO SALT LAKE CITY SIOUX CITY

## THE UNIFLOW BOILER:

The Uniflow return tubular boiler has been designed and built to meet the present demands for the economical



generation of steam. In addition to the advantages of durability, simplicity and low maintenance cost which many years of service of this type of boiler have proven beyond doubt, the Uniflow Boiler is noted for:

1. High operating efficiency.
2. Increased rate of heat transfer.
3. Positive rapid circulation.
4. Great steam disengaging area.
5. Delivery of dry steam.
6. Great overload capacity.
7. Compactness.
8. Cleanliness of heating surface.
9. Reduction of setting losses and upkeep cost.
10. Complete, efficient combustion.

**Efficiency:** The patented tube layout in the Uniflow Boiler equalizes as much as possible the proportion of the gas area to the water content of the Boiler. A most efficient and rapid transfer of heat, therefore, is obtained. The circulation paths in the Uniflow Boiler provide a positive unobstructed circulation of water in the boiler. The steam quickly generated as the result of this efficient heat transfer and positive circulation

rises rapidly to the steam space in the boiler. On entering into the steam space, the steam passes through the large disengaging area. By providing a large disengaging area for the steam, the dangers of priming at overload periods is entirely overcome. The regular guarantee specifies that the Uniflow will develop an efficiency of 74% and operate at 150% of rating without priming.

The ability of the Uniflow Boiler to generate steam quickly, and pick up heavy overloads quickly has been demonstrated by installations in many plants. In every case the Uniflow Boiler has been able to meet the demand for steam quickly without loss in steam pressure. It has been said by many engineers that the quick steaming feature of the Uniflow excels even the water tube type of boiler.

**Smokeless Combustion:** The Uniflow Furnace constructed in every case under the Uniflow Boiler enables the Uniflow to consume bituminous coal as fuel with the smoke emission from the boiler at all times being within the limits of smoke formation as provided by the Local Smoke Bureau.

The compactness of the Uniflow Boiler compares very closely to the compactness of the water tube boiler. In some cases the floor space and head room required by the Uniflow Boiler is considerably less than that of the water tube. In comparison with the return tubular type, the Uniflow contains approximately 50% more heating surface in a given size shell. That is, the usual 72" x 18' return tubular boiler has a nominal rating of 150 horsepower and actually contains 1420 square feet of heating surface. The Uniflow Boiler of the same size contains 52% additional capacity, or 2160 square feet of heating surface, developing 216 horsepower as its nominal rating. A further advantage in the compactness is that the radiation losses from the boiler setting are very much less than the radiation losses in other types of boilers.

More efficient boilers represent the one logical solution of the high fuel cost and fuel shortage problems. The coal saving is actual and proved in practice, and not merely a theory in Uniflow Boilers.

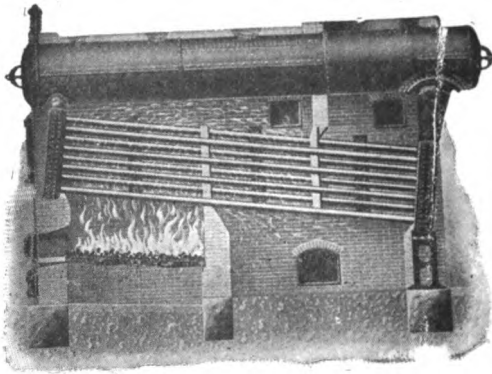
Built in 33 standard sizes—prompt shipments.

# UNION IRON WORKS

ERIE, PA.

Manufacturers of Steel Boilers

Branch Offices and Representatives in Boston, New York, Philadelphia, Syracuse, Buffalo, Cleveland, Pittsburgh, Toledo, Detroit, Chicago, St. Louis, Kansas City and San Francisco



68

The Union Iron Works have been builders of steel high pressure steam boilers for nearly 30 years in Erie. From a modest start today we cover about six acres with buildings consisting of main boiler shop, flange shop, blacksmith shop, machine and casting shop, stack and tank shop. All of these buildings are equipped with modern facilities. See feature No. 7. Our motto "Quality" accounts for our growth and development.

No effort is spared to keep the product up to and ahead of the times if possible by an expert engineering staff.

## THE "UNION" WATER TUBE BOILER:

1. Horizontal drums—liberating surface, dry steam, water storage capacity.
2. Purifier in drums, settling chamber out of fire and circulating element, oil trap, provided with blow-off connection. Additional blow-off bottom of headers.
3. Corrugated flange connection from drums to headers, no restricted area, good

circulation, relieving boiler of internal strains.

4. Headers made in integral halves in one heat, of ample depth, no double plates or rivets exposed to fire, regular, not irregular pitch of staybolts.

5. Handhole plates of steel plate, each removable through hole it covers, no fishing, yoke of novel design, quickly removed. Special shape of handhole, easily kept tight.

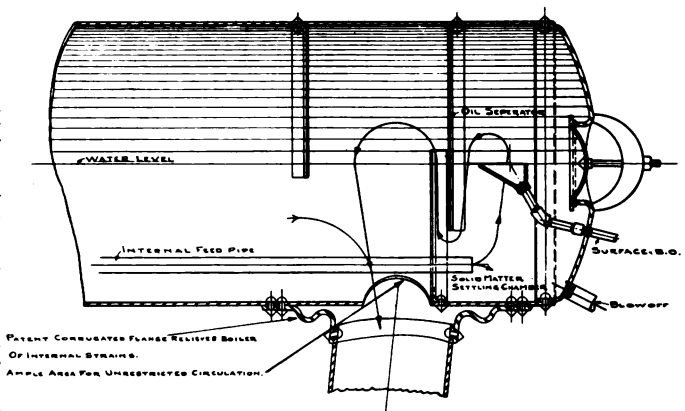
6. Greater inclination of tubes promoting circulation, vertically staggered, horizontal spacing to permit proper cleaning on fire side. Ample gas passage areas.

7. The very best workmanship that can be done by a well-trained organization.

8. Continued operating efficiency and greater overload capacity than any other boiler, due to the combination of these features, resulting in less time required to clean boiler when necessary, longer period of continued efficient operation, minimum loss of time out of service.

We also build a complete line of Fire Tube Boilers and do steel plate work.

Condensed specifications and engineering data specially prepared for consulting and designing engineers, free on request.



*Boilers, Tanks, Steel Plate Work*

## THE WALSH & WEIDNER BOILER CO.

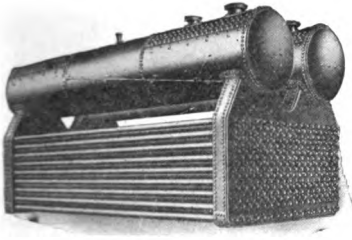
FACTORY AND GENERAL OFFICES

CHATTANOOGA, TENN.

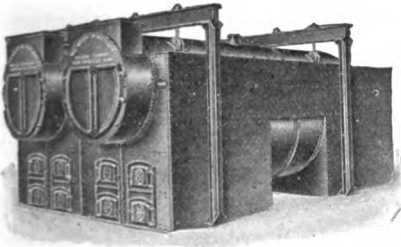
BRANCH SALES OFFICES:—NEW YORK—NEW ORLEANS—DALLAS—BIRMINGHAM—HAVANA

**Manufacturers of Boilers, Tanks and Towers, Storage Tanks, Structural Steel and Steel Plate Work of Any Description**

### HORIZONTAL RETURN TUBULAR AND WATER TUBE BOILERS:



With or without steel casing setting.  
Special furnaces for all kinds of fuels  
or refuse materials.



The steel casing setting may be used either with tubular or water tube boilers and is of great value in preventing infiltration of air into the furnace—thus saving considerable fuel as compared with boilers set in the ordinary brick setting. It is neat looking, occupies less space than the brick setting, and the cost of installation is not materially greater.

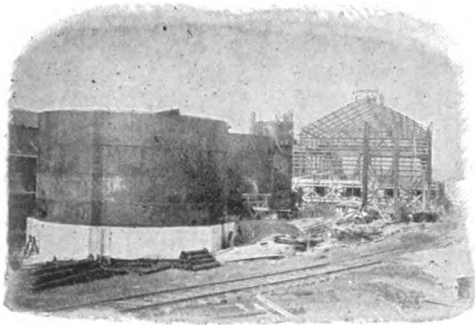
### TOWERS AND TANKS:



Pressure and storage tanks, steel riveted piping and other work for by-products plants, chemical plants and all kinds of industrial work. Oil storage tanks, stills and agitators. Sugar crystallizers and defecators.

### PLATE IRON WORK:

### STRUCTURAL MATERIAL:



All kinds of special plate iron and structural work.

## HENRY VOGT MACHINE CO.

GENERAL OFFICE AND WORKS  
LOUISVILLE, KY., U. S. A.

**Manufacturers of Ice and Refrigerating Machinery, Water Tube and Horizontal Return Tubular Boilers, Sectional Steel Boiler Casings, Drop Forged Steel Valves and Fittings, Oil Refinery Equipment, Paraffine Wax Presses, Distillate Chilling Machines for Cold Test Oils, Welded Vessels, Sectional Rocking and Dumping Grates**

### REFRIGERATION:

Thirty-nine years of effort in the design and construction of the Vogt Absorption Machine has brought forth the present economical and efficient Exhaust Steam unit. By an exhaust steam unit is meant a refrigerating machine capable of developing its rated capacity through the use of steam that has already performed useful work.

A further economy is effected by combining the exhaust steam refrigerating machine with any mill, light or power plant, the refrigeration or ice so produced being virtually a by-product. When it is understood that the operation of such a machine is possible without the introduction of any complicated parts, our correctness of design is thoroughly established.

The workmanship and materials used on our machines are the very best, our drop forged valves and fittings being one of the superior features.

### VOGT EXHAUST STEAM AMMONIA GENERATOR (Patented):

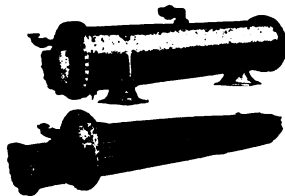
Designed to operate on the lowest possible steam pressure.

The shell and heads are made of semi-steel, this metal being the most durable in contact with hot ammonia.

The coil is made of straight extra heavy wrought iron pipe, and each pipe is closed at one end. The steam is delivered through an inside pipe at the closed end and travels only one time the length of the Generator. This eliminates friction and enables operation at minimum pressure.

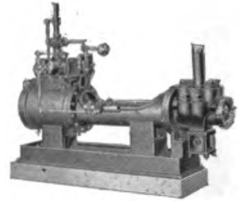
Other special features are:

NO { Return Bends  
Bent Pipes  
Exposed Heating Surface  
Stuffing Boxes on Steam Coils  
Threaded Joints Inside of Shell



### VOGT AQUA AMMONIA PUMP:

The Vogt Aqua Ammonia Pump is designed to handle strong aqua ammonia. The steam cylinder is equipped with balanced piston type valve, governed by an auxiliary valve which is mechanically operated. The steam consumption is exceedingly low for this type pump and the speed is automatically controlled at any desired number of strokes by means of a Mason Regulator. The ammonia cylinder is provided with an extra long stuffing box and water chamber.



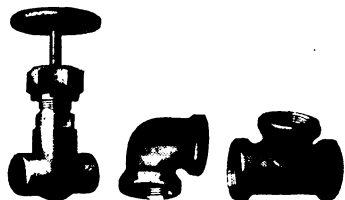
The ammonia piston rod is made of special steel and connected with coupling to the steam piston rod so it can be easily removed when necessary.

The pump is mounted on a heavy sub-base.

### DROP FORGED VALVES AND FITTINGS:

The purchase of low grade valves and fittings is false economy. The one consideration that should govern the choice of valves and fittings is their permanent value—not their first cost factor. The purchaser who overlooks this wide difference between value and price, overlooks the inevitable losses through leaks and breakage which are invariably in excess of the money originally saved.

Vogt forged valves and fittings are in daily service, frequently subjected to intense pressures which no other fitting but a Vogt could withstand. They are especially adapted for high pressures of air, steam, gas, ammonia, water and oil. For the manufacturer of chemicals, of explosives, of hydraulic equipment; for the factory, the mill and the mine these fittings are no experiment—they are a daily necessity.



With a record of excellent service and a guarantee of satisfaction Vogt forged valves and fittings are the logical selection—there can be no reason for not specifying them.

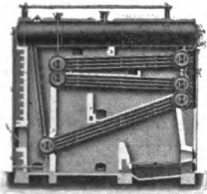


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## HENRY VOGT MACHINE CO.

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### THE VOGT WATER TUBE BOILER:



The exacting requirements of the modern Power Plant are satisfied by Vogt Water Tube Boilers.

Continuous high economy is obtained, due to the design of the boilers and the arrangement of the furnaces for the proper combustion of the fuel.

Low cost of maintenance is secured by the elimination of numerous hand-holes at ends of tubes and by the accessibility for cleaning and inspection, also by the flexibility of construction, effected by the method of suspension which allows for the freedom of expansion and contraction.

High grade workmanship and material is embodied with the most advanced boiler practice, which complies fully with the new A. S. M. E. Boiler Code.

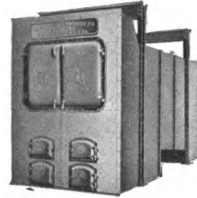
### THE VOGT HORIZONTAL RETURN TUBULAR BOILER:



Vogt Horizontal Return Tubular Boilers are constructed in accordance with the new A. S. M. E. Boiler Code for 125 and 150 pounds working pressure and range in capacity from 45 to 250 Horse Power.

The equipment is arranged to assure ample space between the grates and the bottom of the boiler, also a large combustion area in rear of bridge wall, thus meeting the present-day demand for economical fuel consumption.

### THE VOGT SECTIONAL STEEL BOILER CASING:



The necessity that more perfect combustion be obtained, has made the elimination of the excess air which leaks through brick boiler settings, one of the most important features of boiler setting design.

The Vogt Steel Casing for Return Tubular and Water Tube Boilers constitutes a decided step towards securing this more perfect combustion, as it avoids all leaks common to brick settings.

A considerable saving in the cost of maintenance and in the elimination of expensive delays is effected since the brick lining of the Steel Casing (being tightly sealed) is not subject to the usual expansion and contraction.

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Excess air means wasted fuel. Stopping the leaks reduces the coal consumption. Coal saved is Dollars saved, which is a direct return upon the investment.

### THE VOGT SECTIONAL SHAKING AND DUMPING GRATE:



The Vogt Sectional Shaking and Dumping Grate,  
will save you fuel;  
will cost you less for maintenance;  
will increase the efficiency of your boilers;  
will reduce your fireman's labors.

*Illustrated Bulletins containing detail description of our products will gladly be sent you upon request.*



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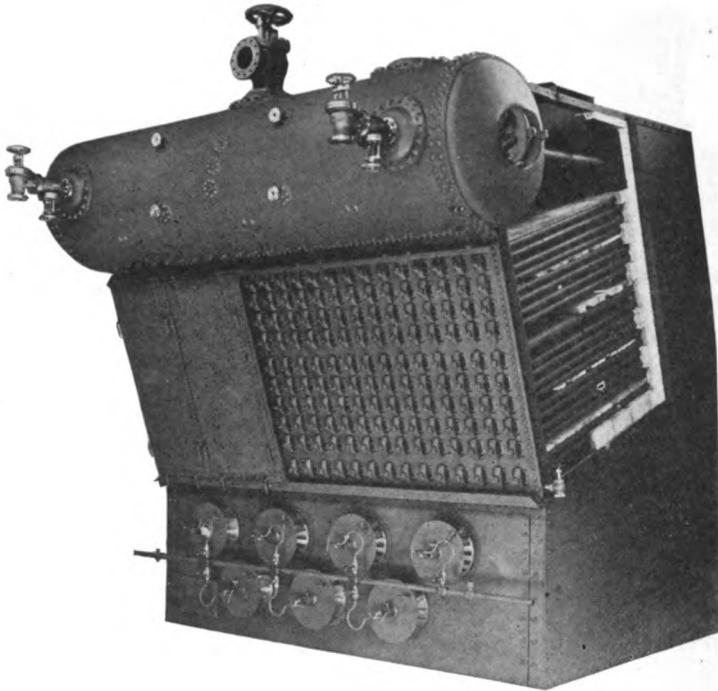
# THE CHARLES WARD ENGINEERING WORKS

CHARLESTON, W. VA.

**Manufacturers of Water Tube Boilers and Marine Engines**

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72



**WARD'S WROUGHT STEEL MARINE BOILER:**

**Improved and Most Rapid Circulation.**

**Generating Tubes Expanded.**

**No Other Joints.**

**No Nipple Connections.**

**No Staybolts.**



Illustration shows Ward Boiler of 4275 Square Feet Heating Surface.

Contracts Awarded as Result of Evaporative Trials.

*16.73 Pounds Water per Pound of Oil.*

*81.68 Per cent Efficiency.*

Built in 60 standard sizes, ranging from 1700 to 5000 S. F. H. S.

**Especially for Marine and Stationary Work where Highest Efficiency is required.**

# THE WICKES BOILER COMPANY

SAGINAW, MICHIGAN

## SALES OFFICES

NEW YORK CITY, 1716 West St. Bldg. PITTSBURGH, 1218 Empire Bldg. DETROIT, 1116 Penobscot Bldg.  
CHICAGO, 76 W. Monroe St. BOSTON, 201 Devonshire St. SEATTLE, 736 Henry Bldg.

## Manufacturers of Steam Boilers

### WICKES VERTICAL WATER TUBE BOILERS AND STEEL CASED BOILER SETTINGS:

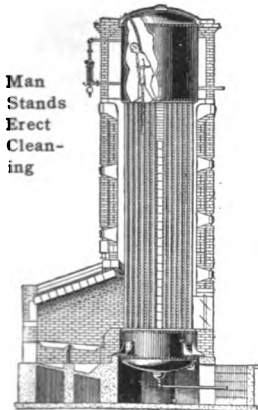
Water Tube Boilers have proved their efficiency. The need is for simple, reliable, durable, thermally efficient boilers. The Wickes Vertical Water Tube Boiler has proven its superiority.

1st. It is simple and mechanical in design.

2nd. It is constructed entirely of homogeneous material, in accordance with the A. S. M. E. Boiler Code; uses straight tubes; fabricated with the highest grade of workmanship; and with the closest tolerances in construction.

3rd. In operation it is reliable, accessible, operates the greatest number of days per year, and delivers absolutely dry steam with the highest possible thermal efficiency.

#### Consider the cleaning, for example:



an average cost of \$2.20 per cleaning.

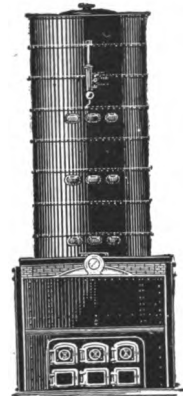
To clean some boilers, where a hand-hole plate at both ends of each tube must be removed, requires an average of six days' work for two men, at a cost of \$19.00 per cleaning.

#### Consider the question of efficiency:

HIGH FURNACE TEMPERATURE results from Dutch oven. Gases entirely surround and closely scrub heating surface from entrance to release.

To wash a Wickes Vertical Water Tube Boiler two 12" x 16" manholes open in this boiler—one top, one bottom. Every tube can be looked through, washed or turbed. Two men can do the job thoroughly in not more than five hours, at

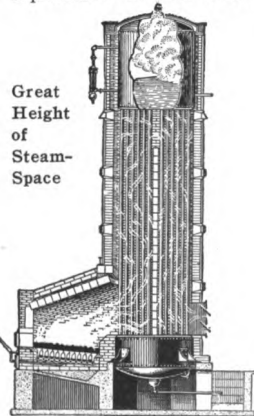
The gases cannot leave heating surface. There is no possible chance for short-circuiting. The boiler heating surface absorbs the heat—empty pockets in setting lose heat. There are no empty pockets in this boiler. A VERY LONG GAS TRAVEL—hence long contact with heating surface is provided. Heat absorption is, therefore, assured. The steel cased settings are always tight. No cracked, warped, leaky, defective and unsightly settings exist with this type. A steel cased setting is a simple and sure cure for air infiltration losses. The largest preventable losses we have to contend with in boiler efficiency are excess air losses.



Steel Cased Setting

#### Consider carefully steam quality:

Did you ever wreck an engine by pulling water over into it from the boiler? Study this boiler. The steam drum gives great height from water line to steam outlet nozzle. This height provides room for separation of the steam from the water which is entrained with it at a point close to the surface of liberation. Since the shell is subject to a mild degree of heat some superheat is effected on the steam leaving this boiler. You do not pull water over from this boiler.



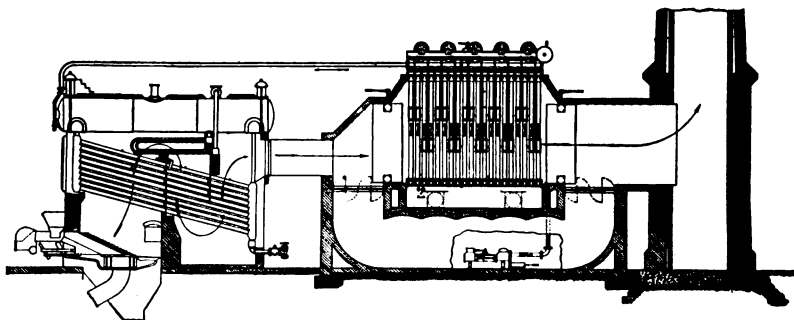
## THE GREEN FUEL ECONOMIZER CO.

BEACON, N. Y.

GENERAL SALES OFFICE: 90 WEST ST., NEW YORK, N. Y.

CHICAGO BOSTON PHILADELPHIA PITTSBURGH CLEVELAND ATLANTA SAN FRANCISCO  
ST. LOUIS LOS ANGELES SEATTLE SALT LAKE CITY KANSAS CITY TUCSON HONOLULU  
Assoc'd with GREEN'S ECONOMISER, LTD.: TORONTO, MONTREAL, WINNIPEG, VANCOUVER  
E. GREEN & SON, LTD.: WAKEFIELD, ENGLAND

**Builders of Green's Economizers; Green's Steel Plate Fans; Green's High-efficiency High-speed Radial Flow Fans; Mechanical Draft Installations**



Typical Installation of Green's Economizer

### GREEN'S FUEL ECONOMIZER:

74

Is the counter-current or multi-stage principle applied to steam generation. The boiler is required for absorbing from the gases of combustion the heat required for vaporization and to provide for the separation of the steam from the water, but the boiler surface should not extend beyond the point where the heat absorbed per square foot is worth less than the annual charges and upkeep upon that square foot. To extend the boiler surface beyond this point is wasteful, since it will not repay fixed charges, and if an economizer is used the boiler can to advantage be terminated before this point.

The Economizer, however, absorbs heat economically from flue gases at temperatures down to 300° F., primarily because it contains water at a temperature lower than that of the boiler contents, giving a greater "temperature head" than in the case of the boiler sur-

face, also because it costs less, square foot for square foot, and is subject to a lower annual percentage for upkeep and depreciation than is the boiler surface.

As ordinarily installed, the Economizer reduces the flue gas temperatures from 600° F. to 300° F., saving 1% of fuel for each 20° reduction in the flue gas temperature. The Economizer pays from 40% to 100% interest upon the investment annually, depending upon operating conditions.

The following is a rough rule for determining the size: Allow about 5 sq. ft. of economizer heating surface per rated boiler H. P.

9' Tube—12.75 sq. ft. Heating Surface.  
10' Tube—13.96 sq. ft. Heating Surface.  
11' Tube—15.17 sq. ft. Heating Surface.  
12' Tube—16.38 sq. ft. Heating Surface.

*For further details and information consult nearest office.*



# LOCOMOTIVE SUPERHEATER CO.

NEW YORK CHICAGO

Designing Engineers and Manufacturers of Steam Superheaters for all Purposes

## SUPERHEATERS FOR STATIONARY POWER PLANTS:

### Introduction:

Years of experience in the design and manufacture of steam superheaters has indicated a number of essential points connected with their design, construction and operation.

### General Description:

The superheater consists in general of two headers, one acting as distribution for the saturated steam coming from the boiler and the other a "superheated" header for the collection of the steam after it has been superheated, and the necessary connecting units in which the

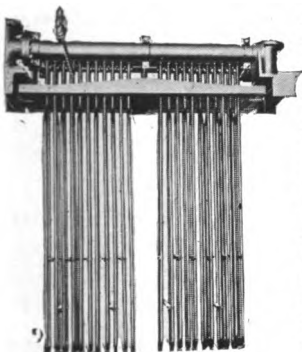


Fig. 1

actual superheating takes place. A typical arrangement is shown in Fig. 1.

### Headers:

The headers are made of steel through-out, and are located entirely outside of the path of the hot gas, and in most de-



Fig. 2

signs entirely outside of the boiler setting. This design makes possible accessibility for inspection without entering the boiler setting. Fig. 2 gives a good idea of the general design of the header.

### Units:

Units are made of heavy, cold drawn seamless tubing of the proper diameter to give correct steam areas. The tube presents a smooth surface offering a minimum of resistance to the flow of

the gases and avoids serious collections of soot. This construction also brings



Fig. 3

the steam into intimate contact with the gas touched heating surface, and gives a low resistance to the flow of heat from the gases to the steam. The form of unit permits free expansion and contraction of all parts. Fig. 3 shows a set of superheater units ready for application to header.

The connection of the units to the header is made through a metal to metal ground joint. This joint is designed to permit easy removal of the units. Any unit may be removed without disturbing any other unit. This is the only metal to metal joint that has withstood the extremely hard service of locomotive operation.

75



Fig. 4

Fig. 4 shows ball end of unit pipe with a clamp bolt and washer used in attaching to header.

### Advantages and Adaptability:

These superheaters are suitable for application to all types of boilers. They provide maximum superheating efficiency and capacity and maximum combined efficiency of the superheater and the boiler, as well as uniformity of superheating effect. Their design and construction provide freedom from leaks, ease of application, accessibility for inspection or repairs, and maximum length of service; maximum superheat obtainable.

These superheaters will accomplish more in power plant fuel economy than any other single factor.



Send for Bulletin. Our Engineers Will Work with You.

## GLASGOW IRON COMPANY

POTTSTOWN, PENNA.

PHILADELPHIA  
603 Harrison Bldg.  
15th & Market Sts.

NEW YORK  
D. F. COONEY & Co.  
88 Washington St.

BOSTON  
HARRINGTON, ROBINSON & Co.  
Sargent Bldg.

**Manufacturers of All Grades of Iron and Steel Plates**

FLANGED and DISHED  
BOILER HEADS.

Flanged Manholes—  
Handholes and Flueholes.

ROE STAMPED STEEL  
MANHEAD and YOKE.

Standard and Heavy  
Threaded Pipe Flanges.  
Companion Flanges — Off  
Center Pipe Flanges.

76

MANHOLE SADDLES.

BUCKLED PLATES.

ROE BOILER LUGS.

Rectangular Flanged Heads.

WELDING AND CUTTING with  
the OXY-ACETYLENE TORCH.

Many shapes formerly  
made in expensive Bronze  
Castings can now be made  
from Steel Plate by Press  
Work in combination with  
AUTOGENOUS WELD-  
ING.

Pressed Steel HOT BLAST VALVES  
and VALVE SEATS, Patented.

BOSH COOLING PLATES—  
TUYERE COOLERS.

FORMING, CUTTING OUT,  
PUNCHING and BENDING Plate to  
order.

Bending and Forming ANGLES and  
SHAPES.

The GLASGOW FLAT FLANGES  
for Riveted Pipe.

Pressed from Steel Plate—For Any  
Service.

Made PLAIN or BORED, FACED,  
HUB BEVELLED, DRILLED, to order.  
Any thickness of plate. 6 ins. to 72 ins.  
INSIDE DIAMETER.

These FLANGES, made with wide  
flanges, make Excellent Expansion Joints  
for Pipe Lines.



*Correspondence Solicited.*

# LUKENS STEEL COMPANY

COATESVILLE, PA.

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A. M. Castle & Co.  
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CONSOLIDATED STEEL CORPORATION, 165 Broadway, New York, is the sole exporter of our commercial products. Address all export inquiries to them.

## FIRST TO MAKE BOILER PLATES IN AMERICA

Over One Hundred Years' Experience.

### LUKENS

**The Leader for furnishing plates for Boilers  
and Fireboxes of All Types**

*All our plate leveled by special straightening  
rolls*

### STEEL PLATES:

"LARGE MARINE BOILER HEADS  
FLANGED IN ONE PIECE.

"LARGEST PLATE MILL (204" rolls)  
IN THE WORLD NOW IN OPERA-  
TION.

"Have furnished heads flanged to 15' 3"  
O. D., 11" flange, 1 1/8" thick. Flat size  
circle required was 198 1/2". They cover  
front and back heads for marine boilers  
which were originally designed in two  
pieces each. These heads were flanged in  
one piece by the spinning process, which  
eliminates seams and consequent riveting.  
They are heated all at one time, thus doing  
away with local strain, and make a better  
job, and can be done more quickly.

"Rectangular plates up to 192" wide can  
be furnished.

"Re-design your boilers, etc., and send  
us your inquiries."

Siemens-Martin O. H., Basic or Acid  
Steel.

Tank, Boiler, Ordinary Firebox, Loco-  
motive Firebox and Special Specification  
Steel.

### UNIVERSAL PLATES:

8" wide up to 48" wide, inclusive,  
1/4" thick and heavier.

### FLANGING:

Machine-Flanged Boiler Heads, Flanged  
and Dished Boiler Heads, Flue Holes of  
any diameter.

77

We can furnish irregular flanged heads  
or would be glad to quote on any special  
flanging as we are especially equipped  
to take care of same.

### "BEST YET" MANHOLE FITTINGS:

Our new Patented Manhole Cover  
Plate has no through riveted bolts.  
Meets all requirements of Steamboat  
Inspection Rules.

### HUSTON PATENT BOILER BRACE:

Superior in quality, strength, lightness  
in weight, workmanship, general appear-  
ance and finish.

Send us your inquiries, stating just  
what you want, and get immediate replies.

## MONONGAHELA TUBE CO.

PITTSBURGH, PA.

Manufacturers of Iron and Steel Boiler Tubes, Oil Well Tubing and Casing,  
Line Pipe, Etc.

### 78 KNOBBLED CHARCOAL IRON BOILER TUBES, SOFT STEEL BOILER TUBES:

Made to American Society of Mechanical Engineers Specifications.

All sizes from  $1\frac{1}{2}$ " to 6" diameter both inclusive.

Particular attention is called to a very important change in the meaning of the thickness of gauge as called for in the boiler tube specifications of The American Society of Mechanical Engineers. The trade custom heretofore in vogue has been that the gauge of the tube meant its average thickness, with an allowance of a variation of one gauge above or one gauge below the one specified. The A. S. M. E. specification, however, states that hereafter all tubes intended for boilers that are to be built according to the A. S. M. E. Boiler Code *must not be less in their thinnest portion than the gauge specified.*

For tubes for locomotives, the old specifications of the Master Mechanics and the American Society for Testing Materials are still in force. It is therefore necessary, when ordering boiler tubes, that the customer state whether they are intended for stationary boilers according to the A. S. M. E. specifications, or whether they are intended for locomotive boilers and their respective specifications.

Tube List No. 6, dated February, 1916, sent on request.

### GENUINE WROUGHT IRON LINE PIPE, OIL WELL TUBING AND CAS- ING:

All Monongahela Pipe and Tubes are manufactured from highest quality material and by the Lap Weld process only under most improved methods.

We carry large stocks for quick shipments.

We make all sizes of Line Pipe  $1\frac{1}{2}$ " to 6" both inclusive, Oil Well Tubing  $1\frac{1}{2}$ " to 4" both inclusive and casing  $3\frac{1}{4}$ " to  $8\frac{1}{4}$ " both inclusive.

Price on Wrought Iron Line Iron Pipe, Oil Well Tubing and Casing sent on request.

Also Sole Manufacturers of:

### "ARMCO" (AMERICAN INGOT) IRON BOILER TUBES, LAP WELD PIPE AND MERCHANT CASING:

In "Armco" goods we make all sizes of Boiler Tubes and Pipe  $1\frac{1}{2}$ " to 6" both inclusive, and Merchant Casing all sizes  $2\frac{3}{4}$ " to  $8\frac{1}{4}$ " both inclusive.

List of "Armco" American Ingot Iron Boiler Tubes, Pipe and Casing, can be had on request.

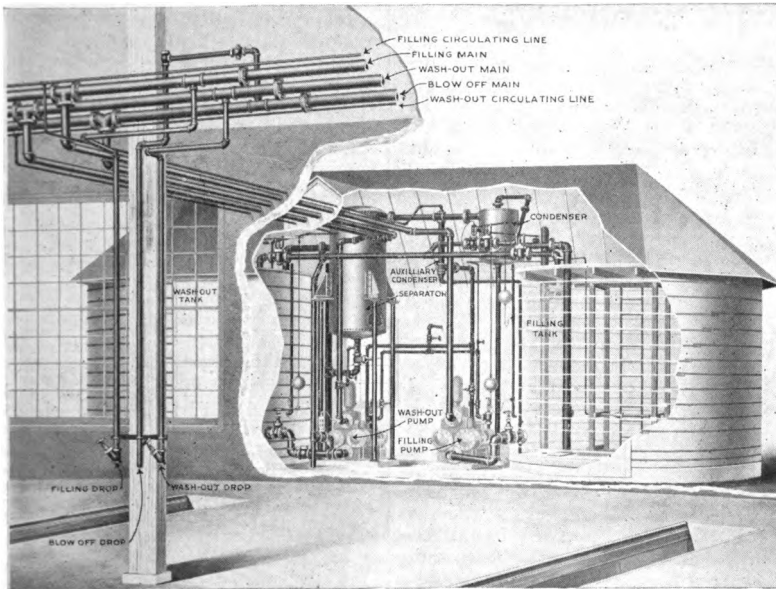
"Armco" Iron Resists Rust.



## NATIONAL BOILER WASHING COMPANY

RAILWAY EXCHANGE, CHICAGO, ILL.

Contractors for General Pipe Work in Railway Terminals



### NATIONAL HOT WATER LOCOMO- TIVE BOILER WASHING SYSTEM:

By the use of this system the blown-out water from a locomotive is saved and used for washing this or other locomotives. The steam from the blown-out water is saved and used to heat fresh water to fill

this or other locomotives. Washing with hot water prevents tearing the boiler apart by rapid change of temperature. Filling with hot water means getting up steam more rapidly. Both mean a very decided saving in coal, water and time.

## THE BAYER STEAM SOOT BLOWER CO.

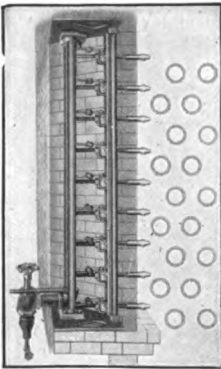
2846 LA SALLE ST., ST. LOUIS, U. S. A.

Manufacturer of Steam Soot Blowers

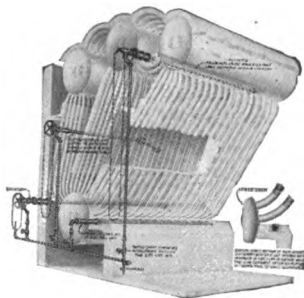
### RECOMMEND THE BAYER:

#### Because—

In actual figures of cost and performance, Bayer Blowers have proved of greatest efficiency, economy and durability. With the Bayer installed, any type of boiler can be thoroughly cleaned of soot and ash accumulations every few hours. The cleaning operation is so simple that it is never neglected; the boilers are always clean. The saving in fuel alone is from 4 to 9%. The Bayer Blower is standard equipment on all Heine boilers and in general use upon practically all other makes. The Emergency Fleet Corporation purchased approximately 980 Bayer Blowers during the past year.



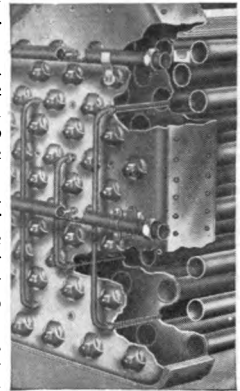
B. & W. Type, showing furnace wall built up under lower nozzles to deflect hot gases



Bayer Blower units as applied to thorough cleaning of the small boiler of the semi-vertical type. Simple, quick, dependable, efficient.

### A Bayer for Every Type of Boiler:

There is a type of Bayer Blower for every type of boiler. Leading industrial plants everywhere have found them economical, easy to install, dependable and satisfactory. Upon installation they soon pay for themselves in the amount of fuel they save. Fuel saving alone is from 4 to 9% in every case. Boiler room costs are also materially reduced by the saving in labor, time and expensive steam hose necessary in the hand hose method of cleaning.

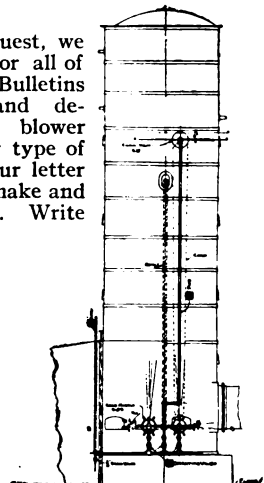


Showing a Bayer Blower installed on horizontal water tube boiler, having hollow stayed water legs. Note the substantial simple construction

For Wickes and other vertical types, there is a number of Bayer Steam Soot Blowers especially designed for the particular requirements of each installation. The number of blowing units, as well as their location, varies according to the conditions.

### Write for Literature:

At your request, we will send any or all of the Bayer Bulletins illustrating and describing the blower suited to your type of boiler. In your letter please state make and H. P. of boiler. Write today, please.



## THE WILLIAM B. PIERCE CO.

43 NORTH DIVISION STREET, BUFFALO, N. Y.

Manufacturer of the Dean Boiler Tube Cleaner

### REMOVES SCALE COMPLETELY

#### THE DEAN BOILER TUBE CLEANER:

A pneumatic vibrator operated on the principle of the steam engine and is driven either by compressed air or steam at varying pressures, depending upon the character of the work to be done. Its vibratory action is secured by forcing the vibrator back and forth at speeds ranging from 4,500 to 10,000 times per minute. The resulting rapid movement of the vibrator communicates a series of vibrations to the boiler tube. This tube being steel and elastic vibrates in unison. Scale however is non-elastic and will not vibrate. Thus the scale is forced to give up its tenacious grip upon the tubes, quickly disintegrates and breaks up into small pieces.

The maximum force of the tap is equivalent to  $2\frac{1}{2}$  foot ounces and with 70 to 125 lbs. pressure it vibrates at a speed of 5,000 to 10,000 times per minute according to the size of the cleaner.

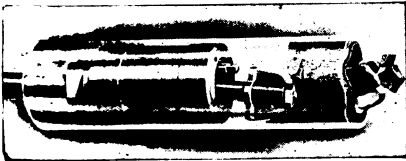


Fig. 1

The Dean Removing Scale from the Tube of a Water Tube Boiler

In water tube boilers the DEAN removes the scale from the inside and the soot from the outside of the tubes in a single operation. In fire tube boilers the DEAN can be used to shake loose the hard baked soot from the inside of the tube before removing the scale from the outside.

The DEAN BOILER TUBE CLEANER may be used interchangeably in fire tube and water tube boilers and with a simple attachment may be used in different sizes of tubes and different types of boilers.

A sectional view of the apparatus is shown in Figure 2. The vibrator .07 is hinged at .09 and carries at its outer end the vibrator head .11 while the other end is formed so as to operate in valve "B." The hinge .09 is carried by the body .50 in which are formed passages "C," one end of which is controlled by valve

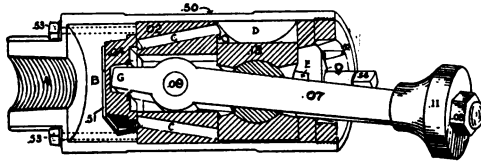


Fig. 2  
Sectional View of the Dean

"B," the other end entering cylinder "D" at opposite ends. Piston .18 surrounds vibrator .07, a ball and socket arrangement being provided so that vibrator .07 may be moved by piston .18.

With the vibrator head in the lower position as shown, the valve admits the steam to the lower end of the cylinder whereupon the piston is instantly forced upward carrying the vibrator with it and causing the head to make impact with the upper side of the tube. The action of the vibrator causes the valve to travel downward and uncover the exhaust port to the cylinder, thus returning the piston to the position shown.

The DEAN cleans every type of boiler—water tube, return tubular, curved tubes, evaporators, condensers, etc., and it cleans them clean.

We are prepared to prove the superiority of the DEAN BOILER TUBE CLEANER over any other method or device on the market intended for the same purpose. If you want to find out for sure what you can accomplish in the way of actual, tangible results with the Dean, just tell us the size of your tubes, the type of the boiler—and let us send you the proper DEAN for FREE TRIAL in one boiler. There's no obligation attached to this offer.

Booklet No. 130—"The Logic of the DEAN"—gives you the facts. It's yours for the asking.

## THE WILLIAMS GAUGE COMPANY

PITTSBURGH, PENNA.

NEW YORK

BOSTON

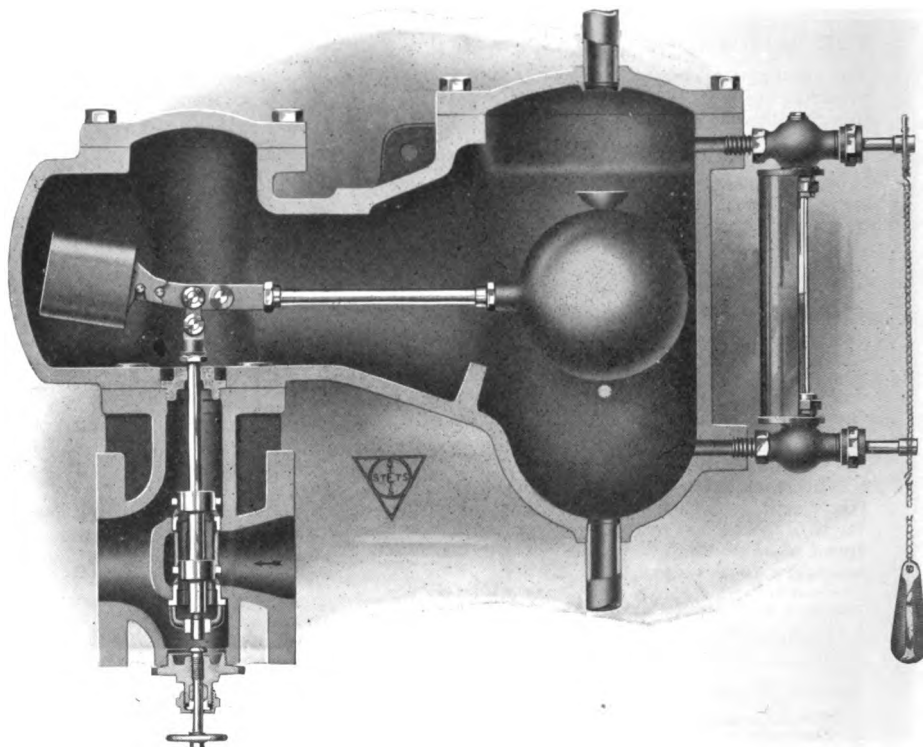
CHICAGO

ST. LOUIS

CINCINNATI

Manufacturers of "Stets" Boiler Feed Controllers, H. & L. Alarm Water Columns, Williams Pump Governors

82



### STETS BOILER FEED CONTROLLER —TYPE B:

If desired, can be used in place of the usual Water Column.

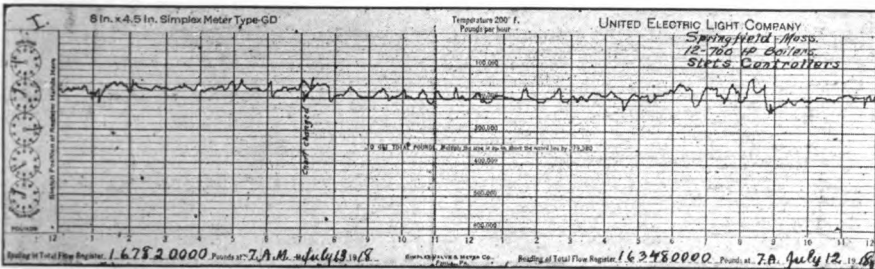
#### Description:

A spherical displacement body, filled with water, and counterbalanced to ride one-half submerged, possesses all the power of a closed or buoyancy float of same size, and for the high pressures used in latest steam practice has no chance for failure. The Stets Type "B" Controller design includes such a relation between weight of water filled float and weight of counterweight and lever arms as will cause float to ride at its middle line at all times. Float will not lose its water content by evaporation because condensed steam which forms in upper steam connection to boiler drips into small

pan attached to top.

Controller is connected to boiler at water level. Whenever water in boiler rises, the float must rise with it, otherwise it will gain buoyancy in proportion to rise in water level around it, and will no longer balance counterweight. Leverage and weight of counterweight then become effective to PUSH valve stem downward. When water level in boiler falls the float loses buoyancy and gains weight proportional to the fall, and its impulsive power then becomes effective to PULL valve stem upward. As leverage is very great and no stuffing box friction on valve stem to prevent gradual movement, a powerful, positive and fine control of valve movement is secured. The valve opening bears a fixed relation to water level. This is accomplished by no other regulator.

# THE WILLIAMS GAUGE COMPANY



Valve is of true balanced piston type. One sleeve serves both pistons and has eight V-Ports—four at upper and four near lower end. By removing jack-wheel entire sleeve may be withdrawn without disturbing valve or breaking pipe connections. Valve stem is guided at its extreme ends. These metal guides are in water and consequently lubricated—hence but little friction. There is sufficient inertia in the mass of the float and counterweight to prevent any quick oscillations of water level from adversely affecting valve control.

THE RESULT OF THIS DESIGN IS A RATE OF FEED PROPORTIONAL TO BOILER WATER LEVEL. THIS IS ACCOMPLISHED WITH FEW PARTS AND BY POWERFUL AND CERTAIN MEANS. AS ALL PARTS ARE IN PRESSURE SPACE THE USE OF A STUFFING BOX IS AVOIDED.

Finer control of flow may be obtained with V-Port Valve than with Disc Valve. The opening of a disc develops a rectangle. As a V-Notch Weir will measure wide range of flows of water more accurately than a rectangular weir, so will a V-Port Valve control flows far better than a Disc Valve.

The feed flow traced on a Boiler Feed Meter Chart is the evidence of efficient or inefficient boiler feeding. Wide sweeps of pen over chart and parallel to ordinates generally indicate action of a Regulator which does not control. As illustrated by chart reproduced herewith, correct mechanical feeding produces a flow line running to some degree diagonal to ordinates and abscissae—never parallel. Feed flow to a working boiler should be continuous and proportional to (1) steam demand, (2) steam flow, (3) furnace temperature. These three constantly changing factors are reflected in boiler water level, therefore feed valve move-

ment should instantly parallel water level movement without lag or delay.

Send for Bulletin "B" and Installation Bulletins for further information.

## WILLIAMS STEAM PUMP GOVERNOR:

This Double Disc Type of Governor is of heavy construction to meet the requirements of severe and constant services. The entire absence of weights, cups or pistons permits of very close adjustment and gives exceptionally smooth operation. The governor is built in either angle or straightway style of body, with flanged or screwed ends.

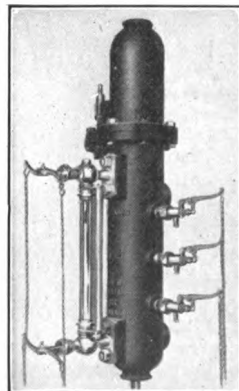


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## "STETS" TYPE-HIGH AND LOW SAFETY ALARM WATER COLUMN:

Especially designed for central station and other high pressure plants.

Has heavy pressure compensating float which prevents collapse under any operating steam pressure. Single float of large displacement but one valve for both high and low alarms instead of two light weight floats with doubled likelihood of trouble.



## SARGENT COMPANY

WEST JACKSON BOULEVARD—DESPLAINES ST.

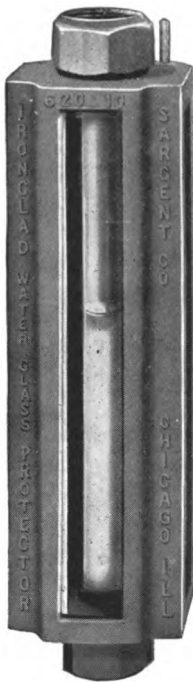
CHICAGO, U. S. A.

New York and Boston Representative: Geo. W. Stetson, 141 Milk St., Boston

**Manufacturers of Water Glass Cocks, Water Glass Protectors and Water Gauges for High Pressure Boilers**

### THE IRONCLAD WATER GLASS PROTECTOR:

This protector is more than a safeguard for the extensively used tubular water glass because it increases visibility



84

of the water level. It is made to suit any existing arrangement of boiler fittings or will be supplied with our E. S. E. Cocks as a unit. The Ironclad permits water level view from three sides. It eliminates the danger of personal injury from bursting gauge glasses. Tubular glasses give longer life when shielded from changes of temperature.

Tested and listed by Underwriters' Laboratories. Recommended for pressures up to 200 lbs.

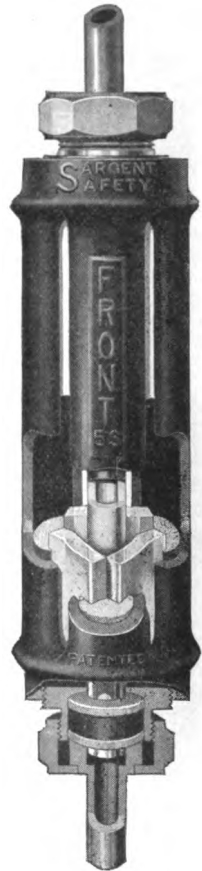
### E. S. E. WATER GLASS COCKS:

Very strongly constructed for long service.

### THE SARGENT SAFETY WATER GAUGE in Two Face and Three Face

form. This

super strong compact containment for the pressure holding tubular glass is a unit structure which allows no explosion and escape of steam when tubular glasses break—except jet through  $\frac{1}{8}$ " warning port. It affords the highest factor of safety conceivable and in service the only deterioration



is in the tubular glass and gaskets which are cheaply and easily renewed. The water level view is clear and distinctive. Recommended for highest pressures.

## THE JAS. A. BRADY FOUNDRY CO.

4524 WESTERN BOULEVARD, CHICAGO

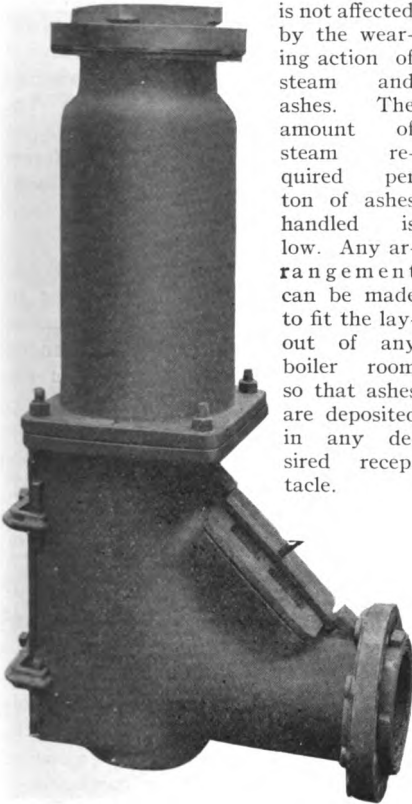
Branches in Principal Cities

**Manufacturers of Steam Jet Ash Conveyors, Traveling Grate Stokers, Coal Scales and Flat Arches. General Foundry Work**

### BRADY STEAM JET ASH CONVEYORS:

Brady Steam Jet Ash Conveyors save labor and cost in the handling of ashes in any boiler room. They are made of Brady metal, a hard alloy that

is not affected by the wearing action of steam and ashes. The amount of steam required per ton of ashes handled is low. Any arrangement can be made to fit the layout of any boiler room so that ashes are deposited in any desired receptacle.

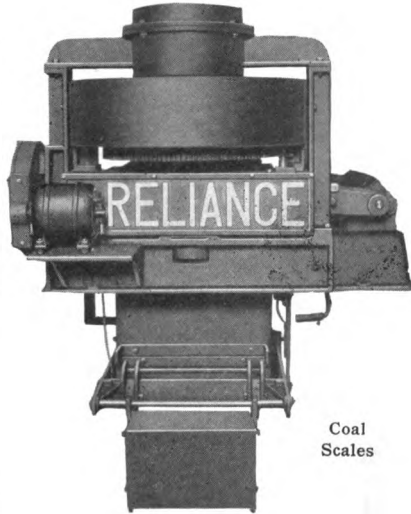


Steam Jet Ash Conveyor

### BRADY COAL SCALES:

The "Reliance" coal scales are not only accurate in measurement but are absolutely dependable. Heavily built, they stand up under the hardest kind of power

plant usage, with little or no maintenance cost.

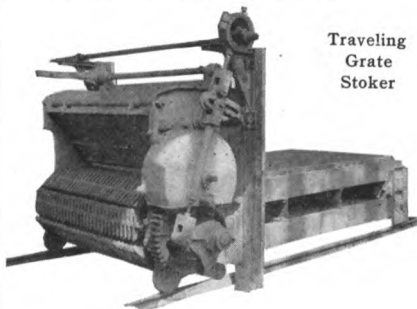


Coal Scales

85

### BRADY TRAVELING GRATE STOKERS:

Brady Traveling Grate Stokers have been designed by combustion engineers, and are built complete in our own plant. Maintenance cost is unusually low. Even the poorest grades of fuel can be burned successfully with this stoker, and high overload ratings can be maintained over long periods of time.



Traveling Grate Stoker

*Write for Complete Bulletins on Brady Power Plant Equipment.*

## COPPUS ENGINEERING AND EQUIPMENT COMPANY

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WORCESTER, MASS.

BRANCH OFFICES: NEW YORK, PHILADELPHIA, PITTSBURGH, HAZLETON, PA., BIRMINGHAM, ALA.,  
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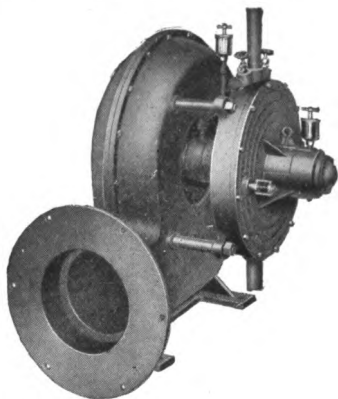
**Engineers and Manufacturers of Turbo Blowers, Steam Turbines and Turbo Pumps**



### TURBO BLOWERS:

Are made in two styles, Propeller and Centrifugal. The Propeller type blowers are adapted for delivering large volumes of air at low pressures and are largely used for forced draft for boilers. The Centrifugal type is fitted for smaller volumes at higher pressure and are used extensively in connection with Gas Producers and for industrial purposes.

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Coppus Turbo Blower

**Construction:** Coppus Turbo Blowers consist of a single or double stage Impulse entirely enclosed on the same shaft with the Propeller Fan. The particular use for which they are intended requires the utmost simplicity of apparatus and absolute fool-proof provision, as the blower is generally located and operated where ash and dirt are plentiful.

The Coppus will stand a great deal of abuse without any harm being done to

the machine. Even if it was covered with soot and ashes no dirt or dust would enter the bearings and we recommend to apply the water or steam hose for cleaning fan and casing occasionally. The blower needs no attention on account of an oiling system which maintains a constant oil level for the ball bearings even if the oil supply diminishes. The blower is very sturdily built of the finest materials obtainable, and is absolutely guaranteed as regards quality and workmanship.

Special attention has been given to the design of the fan casing in order to insure the highest efficiency. The casing closely hugs the fan and is expanded immediately beyond. This relieves the choking effect on the air by the casing, greatly eliminates friction, and prevents the formation of eddy currents.

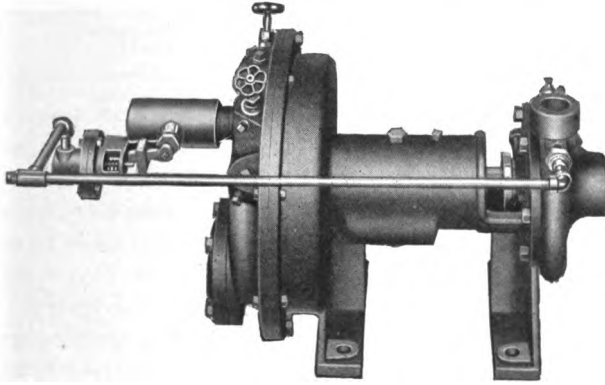
**Advantages:** Coppus Turbo Blowers automatically operated by means of damper regulator and balanced valve give a perfect draft control. They give draft adjusted to the coal—handling any and every grade with utmost economy.

They give flexibility of draft immediately variable to sudden changes in steam demand. They give absolute emancipation from weather conditions—draft that is better than the most favorable natural draft.

Thus constant steam pressure is always assured regardless of load, fuel, or weather conditions if the boilers are equipped with Coppus Turbo Blowers. We are equipping from one hundred thousand to two hundred thousand boiler H. P. per month.



## COPPUS ENGINEERING AND EQUIPMENT COMPANY



Type CCC Pump



### CENTRIFUGAL TURBO BOILER FEED PUMPS:

TABLE OF CAPACITIES

Size	Type	Capacity	Maximum Pressure
1¼	CCC	100—500 BHP	135 lb.
1½	CCC	500—1000 BHP	150 lb.
2	CCC	1000—1600 BHP	175 lb.
3	CCC	1600—3500 BHP	175 lb.

**Type TB:** Capacities up to 4000 boiler H. P. and any pressure.

**Construction:** In our Type CCC both Turbine and Pump overhang the bearings which makes for simplicity in construction. The pump is of necessity single stage. One oil reservoir serves both bearings and on account of a very ingenious oiling system the oil level for the ball bearings is maintained regardless of the oil in the oil chamber. The pump contains only one stuffing box, in which we use a guaranteed metallic packing. It is a compact, complete unit eliminating the possibility of disalignment.

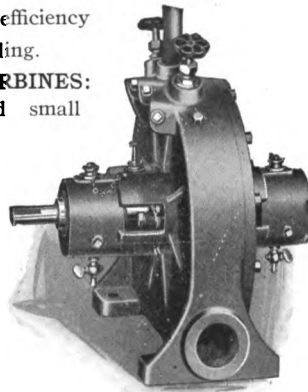
In our Type TB the Pump and the Turbine have out-bored bearings. Where the boiler pressure makes it necessary

the Pump is built multi-stage and is split vertically. Like the Type CCC it is a self-contained unit, one single shaft carries the propellers and steam turbine.

These pumps are strong and compact, carefully constructed according to the best principles of modern pump practice and have proved exceptionally economical in operation. They give a steady flow of water to the boiler without pulsation; they require practically no attention. They have few moving parts to wear out, and when installed with our automatic regulator and safety stop, represent the highest possible efficiency in boiler feeding.

### STEAM TURBINES:

We build small steam turbines up to twenty-five H. P. for either belt or direct connection to propellers, dynamos, blowers and pumps.



Coppus Steam Turbine

## THE ENGINEER COMPANY

17 BATTERY PLACE, NEW YORK CITY

### BRANCH OFFICES

BOSTON  
HAZLETON, PA.  
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### **Balanced Draft**

Proposed exclusively by The Engineer Company

A constant pre-determined draft at all times—for all rates of combustion.

A better combustion system—a system of control which secures *automatically*:

1. The supply of air for best combustion.
2. A correct flow of the waste gases from the furnace.
3. When stokers are used, the right amount of fuel for each furnace.

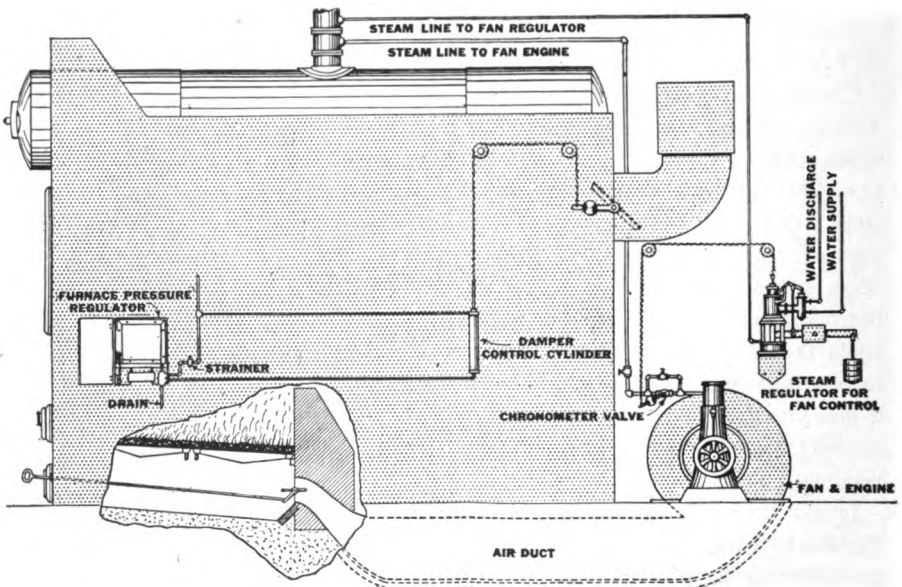
The illustration beneath shows Balance Draft applied to a hand-fired boiler. The furnace pressure regulator controls the flue damper. The steam pressure regulator controls the speed of the blower. The operation of both controls is entirely automatic.

A correct draft depends upon the fuel used, the boiler design and firing conditions. When the regulator is set for the point of highest efficiency it constantly maintains it. Under these conditions the percentage of  $\text{CO}_2$  is increased. Stack temperatures are lowered. The efficiency of the heating surface is greater, and the capacity of the stack is increased.

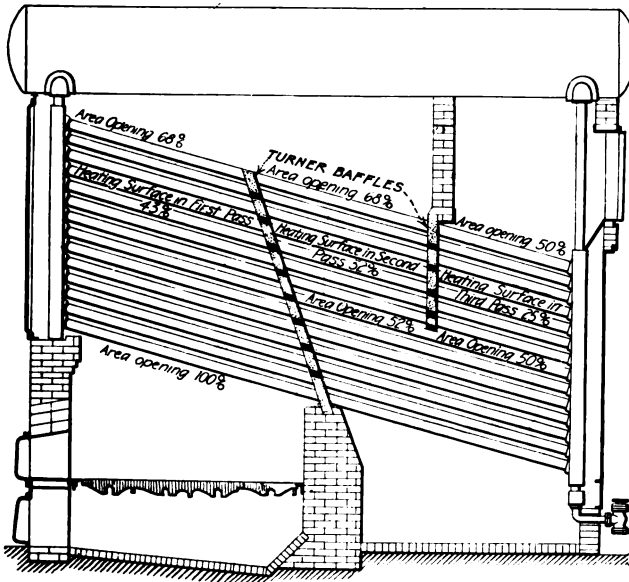
Burn any fuel—coal, oil or gas. Balanced Draft insures the fuel getting the right amount of air for best combustion—no more, it will reduce the velocity of heat gases through the boiler, and prevent outside air leakage from diluting the heat.

The net result is more power at less cost. *Complete information on request.*

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# THE ENGINEER COMPANY



## Turner Baffle Walls

Produced exclusively by The Engineer Company

The Turner Baffle Wall is composed of fire brick and fire-resisting cement in a plastic condition. It is built by our own expert workmen with our own materials and can be easily built from the inside without the removal of the side walls. Can be used in any type of boiler or superheater where the tubes pass through the baffle; a carefully worked out engineering structure.

Built at the right slope, without limitations as to angles, the bridge wall may be carried back to any position. This increases the radiation surfaces of the lower rows of tubes and largely prevents clogging, due to flying slag particles and also reduces the effect of reflected heat on stokers and furnace lining.

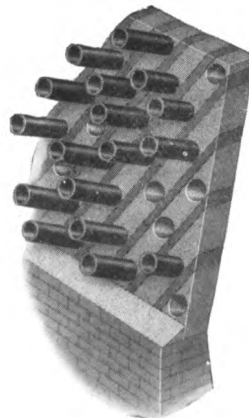
Turner Baffles are built tight. They

stay tight—under most severe firing conditions. Cannot loosen, spawl, flake off or crumble. Tubes can be withdrawn without injury to the walls.

In use in boilers totalling over 200,000 horse power.

*Complete information on request.*

**"Tight  
as a  
Drum"**



## B. F. STURTEVANT COMPANY

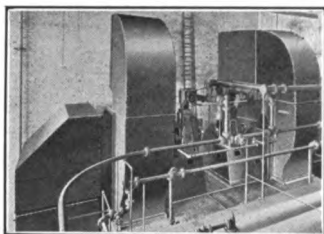
HYDE PARK, BOSTON, MASS.

Offices in All Principal Cities

**Mechanical Draft, Fuel Economizers, Steam Turbines, Steam Engines, Gasolene Engines, Gasolene Engine Generating Sets, Motors, Generators, Steam Traps, Heating and Ventilating Systems, Fans, Blowers, Exhausters, Etc.**

### MECHANICAL DRAFT:

Draft produced by a fan is called mechanical draft, and may be forced or induced as conditions demand. Its cost is from 20 to 40 per cent of that of a chimney. Its intensity permits of the burning of finely divided or low grade



90 fuel. It makes possible the utilization of the flue gases which a chimney wastes in producing draft, it is independent of the weather, decreases smoke, increases the capacity of an existing plant, and serves as an auxiliary to a chimney already overburdened. It saves space and is portable.

### FUEL ECONOMIZERS:

The Sturtevant Economizer effects:

A saving of 5 to 15 per cent in fuel.

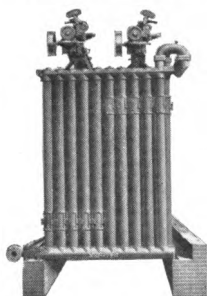
An increase of 10 to 25 per cent in boiler capacity.

An appreciable extension of the life of a boiler.

A purification of the feed water.

A reduction in expense of repairs.

The deposit of large amounts of soot.

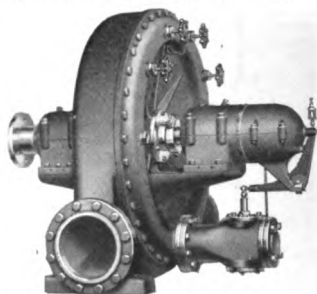


hot gases by directing them between the pipes and against those standing in their paths.

In the Sturtevant Economizer the pipes are arranged "staggered" instead of in straight rows, thereby giving the pipes a better opportunity to absorb heat from the gases. These economizers are made with taper metal-to-metal joints that require no packing, cement or rusting. The placing of the pipes of one row opposite the spaces of the adjacent sections increases the effective area of the transmitting surfaces and thoroughly breaks up the currents of

### STEAM TURBINES:

The Sturtevant Steam Turbine is of the multi-velocity type, and its operation is such as to give high efficiency, and permit of moderate rotative speeds without gears. Hand valves are used for shutting off the nozzles, and the speed is regu-



lated by a centrifugal throttling governor placed on the end of the shaft.

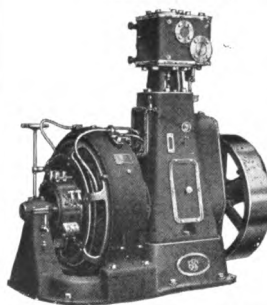
Internal lubrication is unnecessary, therefore the exhaust steam is free from oil.

5 regular sizes from 5 to 250 H. P.

Approximate speed from 4000 to 1000 R. P. M.

### STEAM ENGINES:

(Automatic High Speed)



Vertical Single Cylinder from 1 to 150 H. P.

Sturtevant Engines are adapted to continuous operation for long periods without attention. Gravity lubrication and complete enclosure of moving parts insure cleanliness and high mechanical efficiency. Rites Governor

gives 1½ per cent speed regulation on automatic engines.

### MOTORS, GENERATORS AND GENERATOR SETS:

Direct Current Apparatus for any Standard Voltage

Bi-Pole Motors (enclosed and semi-enclosed type).....	¼ to	3 H. P.
Four-Pole Motors.....	2 to	30 H. P.
Eight-Pole Motors.....	1 to	225 H. P.
Six-Pole Generators.....	5 to	17½ K. W.
Eight-Pole Generators.....	20 to	150 K. W.
Turbine Generating Sets.....	3 to	50 K. W.
Steam-Engine Generating Sets.....	5 to	150 K. W.

## B. F. STURTEVANT COMPANY

### STEAM TRAPS:

Sturtevant steam traps made for different pressure, are designed for steam heaters or radiators of any construction. Both extension and cone are of brass ground to a fit. The pot is readily removed for cleaning by loosening the bolts.

### PROPELLER FANS:

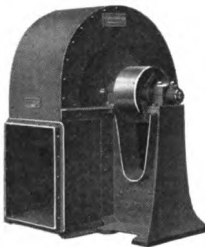


Propeller fans are designed for use against low pressures, and are applicable for ventilation and exhaust work in boiler and engine rooms, kitchens, clubrooms, smoking rooms, offices, stores and similar places.

They are constructed with a frame of cast iron that is fastened into the wall of the building and are driven by either belt or direct-connected electric motors. The construction of these propeller fans is exceptionally strong and durable. Propeller fans are made in sizes of from 18 to 120 inches in diameter.

### MULTIVANE FANS:

Multivane blowers and exhausters driven by direct-connected Sturtevant motors, turbines, and engines form the most satisfactory and efficient fan sets on the market. The blast wheel or runner for this fan

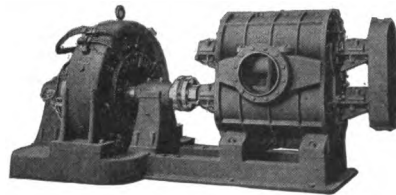


is composed of shallow floats, which permit the use of very large inlets while maintaining the necessary blade area. The large inlet allows the air to enter with the least loss in friction. Each blade or float is spooned to distribute equally the pressure within the casing and to add rigidity and strength to the wheel.

### STEEL PLATE FANS:

Sturtevant steel plate fans are designed for all classes of blower and exhaust work. They are the result of fifty years' experience in blower design, are especially strong and durable and are suitable for direct-connected steam engine and electric motor drive and for belt drive. Steel plate fans are built for ventilation and mechanical draft installations, and for planing mill and other exhaust work.

### BLOWERS AND EXHAUSTERS:



Positive Pressure Blowers are designed to deliver air at pressures up to five pounds. They are especially adapted to furnishing blast for cupolas, gas and oil burners, annealing and smelting furnaces, cement kilns, and for all sorts of blower or exhauster work demanding high pressures. Special stuffing-boxes to prevent leakage are furnished when these blowers are used to handle gases.

The Sturtevant Positive Pressure Blower is made in two types; in the smaller sizes the idler is directly above the impeller, and the shafts lie in a vertical plane. In the larger sizes, the shafts are in a horizontal plane, the intake and discharge being at the bottom and top.

The B. F. Sturtevant Company makes complete installations, including direct-connected, belted, or geared engine or motor, exhaust, automatic regulator, blast gates, by-pass connections, and valves.

### STURTEVANT HEATERS:

The Sturtevant fan system of heating and ventilating is economical and positive, heated air providing ventilation as well as heat. Indirect hot blast coils are built of one inch extra heavy steel pipe screwed into cast iron sectional heater bases. Entire heater is enclosed in steel plate casing. Heater is applicable to use of either live or exhaust steam or hot water. System can be used for heating and ventilating any kind of building. The operation is independent of the weather or of atmospheric conditions. By the use of the Sturtevant air washer, the air may be washed at all times, and cooled in summer. Hot air from the heater is forced by a fan through ducts into the building to be heated, and is allowed to escape through vent flues. Fans are driven by steam engine, motor or belt. The steam engine exhaust is used in the heater, thus obtaining heat at practically no expense. Temperature of air entering each room may be closely regulated by thermostatic control.



## THE AUTOMATIC FURNACE COMPANY

DAYTON, OHIO

**Manufacturers of the Model Automatic Furnace, Model-Chicago Chain Grate Stoker, Dayton Coal Feeder, Culver Shaking and Dumping Grates and the Model-Acme Steam Engine**

### MODEL AUTOMATIC SMOKELESS FURNACE:

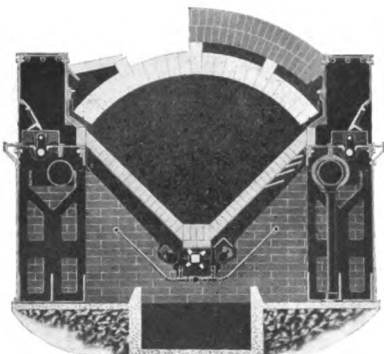
The Model Automatic smokeless furnace is so designated because it is an improved form of the side-feed type and embodies greater utility than any other make or type.

The devices for getting rid of the ash have been so designed and perfected that the furnace keeps the fire clean all the time. The clinker and other coarse refuse, as well as fine ash, are constantly and automatically discharged in the ash pit underneath the grate, and a clean, live fire is maintained at all times, even when low grade fuel is used.

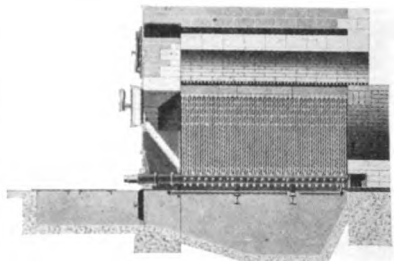
92 The Model Automatic is operated on natural draft and is not only superior in constant, efficient self-cleaning and smoke prevention, but is also designed to, and does, give efficient protection. When repairs are necessary renewal of any part can be made readily without disturbing other parts.

The principal parts of the furnace are not exposed to damage and will last a lifetime. The grates are in pairs, one piece of each being stationary and the other movable. They are set in, but not fastened, the lower end resting on the grate bearer, which, with the sectional clinker grinder, forms the longitudinal center of the grate surface.

Illustrations show the narrow surface of each grate that is exposed to the heat



Cross-section through the Model Automatic Smokeless Furnace Showing Single and Double Arch Construction



Longitudinal Section through Center of Furnace

and the broad surface on which the air acts and cools as the air is drawn from the ash pit up between the grates into the fire bed.

The coaling process is made the more effective by reason of the automatic cleaning, keeping the air spaces always free of ash, clinker, and other choking refuse, thus avoiding sticking or sliding and maintaining an even fire bed.

Each pair of grates can be renewed separately and each section of the bar that grinds up and discharges the clinker and coarse refuse can be renewed separately and, if necessary, without putting the furnace out of commission or seriously interfering with its operation.

Air enters the fire chamber and is so admitted as to avoid overheating of the fire arch, arch plates and other parts and insures instantaneous, complete combustion.

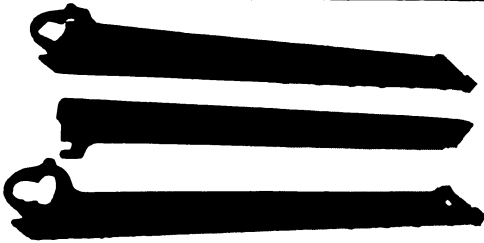
**Draft:** The Model Automatic operates with either natural or induced draft.

There are models where ample draft is available that have crowded 500 H. P. boilers to 1500 H. P. for days at a time, maintaining a clean stack and there are no cinders to trouble the neighbors, as is experienced with furnaces requiring forced draft.

**Automatic Regulation:** A combination draft and fuel feed regulator can be applied, so that the rate of fuel feed, air supply and combustion correspond to the steam requirements.

**Adaptability:** The Model Automatic can successfully handle and burn with superior economy any known bituminous coal mined in this country or in any foreign fields, can be adapted to any make or form of boiler and to almost any

## THE AUTOMATIC FURNACE COMPANY



Movable and Stationary Grate Bars  
Separately and in Pairs as They  
Are Set in the Furnace

condition of boiler room or fuel or duty requirements.

No other mechanically operated furnace lends itself more advantageously to economic use of mechanical coal or ash handling. The clinker and other coarse refuse is broken up, so the ash is in suitable condition for any desirable method or system for ash handling.

**Repairs:** The construction and arrangement of the Model Automatic furnace provides for a maximum self-protection to all parts subject to damage by heat or wear, and there is, therefore, a minimum cost for maintenance. The fuel saving is sufficient to pay for the necessary repairs and also to give a large return on the cost of installation.

**Operation:** A small steam engine or electric motor is furnished with each furnace, battery, or row of furnaces driven through a set of double worm gears, thus giving ample power with use of little steam.

Mechanisms for operating both the stoking and cleaning arrangements are on the outside of the front, not exposed to the heat of the fire. Each part can be disconnected and connected up again without stopping engine or motor. Motion of clinker grinder can be varied to suit amount of refuse in the coal by simply pulling out a single pin and replacing it in desired position, to keep the fire clear of refuse and not waste combustible in the ash.

### CHAIN GRATE:

This company also manufactures the Model Chicago chain grate. It is of rugged, heavy construction and is designed to stand the trying service of boiler room equipment. Detailed description will be gladly sent on request.

### DAYTON COAL FEEDER:

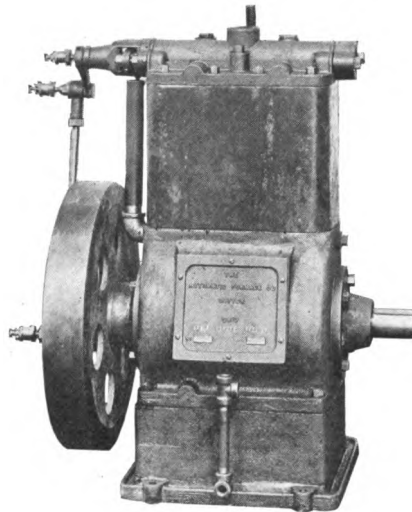
• We also manufacture the Dayton Coal Feeder, adaptable to light duty and heating plants. This feeder is easily attached as it merely displaces the fire door. It reduces amount of attention required on the part of the operator and does away with the smoke nuisance.

### CULVER SHAKING AND DUMPING GRATE:

This company also manufactures the Culver Shaking and Dumping Grate, which has been in use for many years and has no equal in hand firing economy and low cost of maintenance. Detail information will gladly be furnished on request.

### MODEL ACME STEAM ENGINE:

**Uses:** There are now thousands of Acme engines in operation, and owing to their rugged construction, simple and durable design, they have no equal, operating as they do with the minimum amount of attention.



Model Acme Steam Engine

**Description:** Engine is of the single acting, two cylinder type. Designed to operate under a steam pressure of from 80 to 200 lbs. and a speed of 150 to 600 r. p. m. A pair of vertical cylinders are placed above an enclosed crank case which serves as a rigid foundation for the engine as well as reservoir for the oil used in the automatic splash system of lubrication.

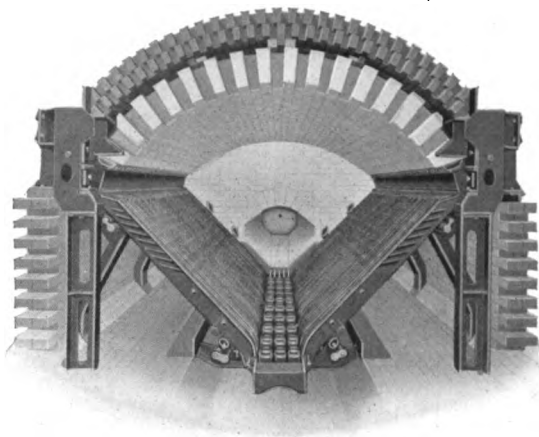
It is provided with generous sized ports for quick inlet and exhaust of steam. Valve is a one piece casting ground to fit an accurately bored chamber, the latter piece also serving as a cylinder head. Automatic relief valves are provided in the top of the cylinder head to insure quick release of any water which may collect in the cylinders, thereby eliminating any chance of damage from this source.

All bearings of this engine are of ample size and are continuously lubricated by a positive splash system contained in the crank case.

## DETROIT STOKER COMPANY

DETROIT, MICH.

### THE DETROIT "V" TYPE STOKER:



Rear View—Detroit "V" Type Stoker with Radial Sprung Arch

tion, and can be easily replaced without disturbing the Arch or brickwork.

This Arch insures high furnace and boiler efficiency and capacity as the gases of combustion are distributed evenly across the entire width of the Boiler.

The Arches are cooled by air admitted through openings in the front of the Stoker and being preheated passes into the furnace under control, through the tuyeres over the coking coal supplying the oxygen for combustion.

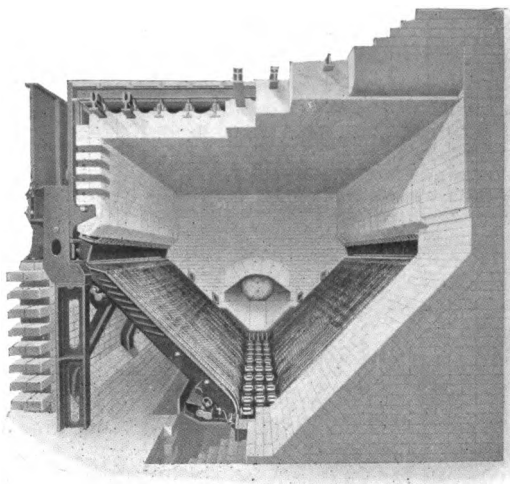
94 Coal is continuously fed from the Coal Magazines to the upper end of the Grates. Each alternate Grate has a slicing motion which prevents clinker from forming on the Grates and keeps the entire fuel bed moving towards the Clinker Crusher at the bottom.

The Clinker Crushers have a continuous motion, grinding the clinkers and depositing the refuse in the Ashpit below.

The Detroit Stoker can be equipped with either the Radial Sprung Arch or the Detrick Flat Suspended Arch. Each tile of the Flat Arch is independently suspended from the center, allowing free expansion and contrac-

Adjustments of the Stoker are easily and quickly made to meet any conditions of load or any grades of fuel.

*Send for Catalogue D. Address Detroit Stoker Company, Detroit, Mich.*



Rear View—Detroit "V" Type Stoker with Detrick Flat Suspended Arch



## THE ILLINOIS STOKER CO.

ALTON, ILLINOIS

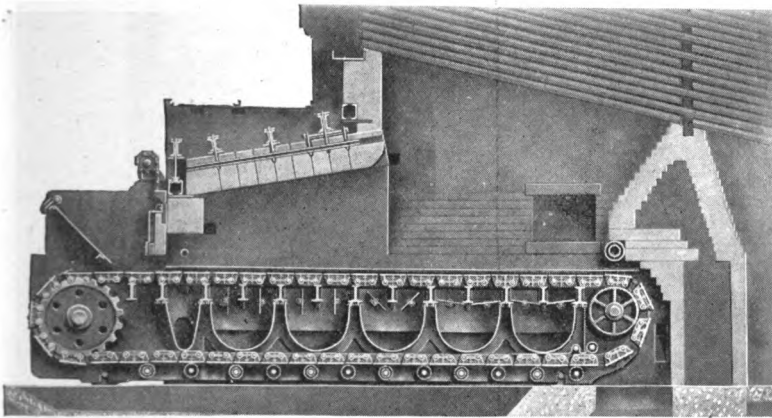
Originators of Down Draft Chain Grate Stoker

The efficient firing of boiler fuel requires, first, the provision of a rapid and continuous system of ignition, and, second, an even and intense combustion of the fuel as it passes through the firing area. Naturally, these are features that depend almost entirely on draft mechanism and control.

The ignition of fuels entering a combustion chamber over an **ILLINOIS CHAIN GRATE STOKER** is positive and immediate because of the exclusive *down-draft* feature embodied in its construction, by means of which an *induced* draft draws the hot furnace gases *down* through the fuel at the moment

part, is a series of ten individual dampers—the illustration shows them adjusted at various angles. Each damper extends the entire width of the grate, and can be operated independently of all the others by means of socket wrenches extending through pipes in the setting wall.

After ignition, the fuel passes successively through the individual draft zones, to each of which (due to the independent action of the controlling dampers) the air current can be applied by forced up-draft at a rate that will insure the generation of the proper *quantity* of heat at the proper *intensity*. In other words, the operator has perfect control of forced up-



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it enters the combustion chamber. This not only insures rapid and vigorous ignition, but entirely eliminates the difficulty so often encountered in the ignition of fuels of low volatilization. In fact, anthracite culm, coke breeze, and bituminous coal can each be used as efficiently as a higher grade fuel.

It is a fact, known of course to every engineer, that the most difficult firing problems are those of obtaining complete combustion, together with proper regulation and control of air. Just how this is successfully accomplished in the Illinois Chain Grate Stoker can best be understood by reference to the accompanying illustration and the explanation which follows.

Built into the stoker, as an integral

draft air currents at any point throughout the length and width of the fuel bed.

Naturally, as the fuel is carried into the combustion chamber and is dissipated, the air currents can be reduced through the damper control until the fuel reaches the rear.

This combination in the Illinois Stoker, of induced down-draft ignition with forced up-draft combustion, means a high furnace efficiency, positive control of both the quantity and intensity of heat through flexible damper regulation, better  $\text{CO}_2$  control, plus the ability to meet varying load conditions.

Your individual problem will receive special attention.



## MURPHY IRON WORKS

FOUNDED 1878

DETROIT, MICHIGAN

Manufacturers of the Murphy Automatic Furnace

**THE MURPHY AUTOMATIC SMOKELESS FURNACE** is automatic in all its functions. It continuously feeds and distributes the coal and removes the ash and refuse.

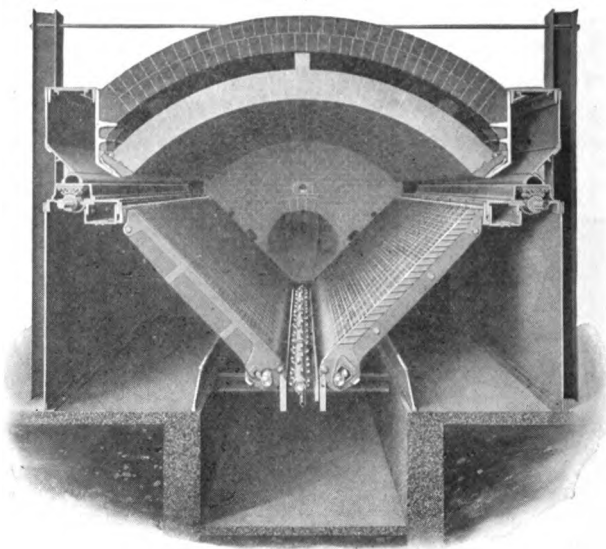
It is adaptable to any type of boiler and to units of any size—50 H. P. and up.

It will handle economically all grades of bituminous fuels and will burn other

Murphy Furnace demonstrates especially the advantages of over 40 years of stoker experience.

Refinements in design and construction have reduced the cost of operation to the lowest limit.

The cost of operation is less than 1%, due principally to the use of natural draft, balanced mechanism and ease of actuation.



The Murphy Automatic Furnace  
REAR VIEW

fuels efficiently enough when bituminous coal is not available.

It is capable of handling variable loads and heavy overloads efficiently and with minimum attention.

The cost of maintenance is low, averaging about 10c. per horsepower per year.



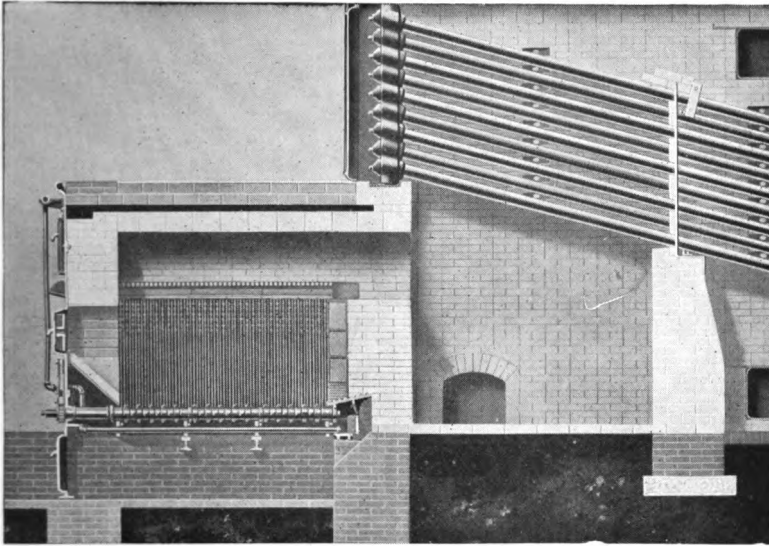
In cost of operation the

The arrangement of the grates, commonly known as "opposed type," offers many advantages. It gives double the coking area—necessary for smokeless combustion. It eliminates loss of heat due to radiation through side walls. It permits passing the air through the arch when it is preheated, effecting a further saving in heat units.

## MURPHY IRON WORKS

At each side of the stoker extending from front to rear are the coal magazines into which the coal may be introduced either by hand or mechanically. At the bottom of these magazine are the coking plates against which the inclined grates

form a series of air ducts immediately over the coking plates, conveying the heated air from the chamber above the arch into the combustion chamber. These arch plates also form the walls of the magazines. The stoker, or battery



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Murphy Automatic Furnace—Dutch Oven Setting

rest at their upper ends. The stoker boxes, operated by segment gear shafts and racks, push the coal over the coking plates and on to the grates. The grates are made in pairs, one fixed and the other movable. The stationary grates at their lower ends rest on the grate bearer, which also acts as a support for the clinker grinder. The clinker grinder consists of a steel shaft, on to which is slipped cast iron toothed segments, which are readily replaced in case of breakage.

Just over the coking plates are the arch plates, from which a fire brick arch is sprung over the entire stoker. Upon these arch plates are cast numerous ribs to

of stokers, can be operated by a small automatic engine, motor or by overhead shaft and ratchet drive, as may be desired. Arrangement is made for exhaust steam connections at the lower end of the grates for the protection of this portion of the grates and clinker grinders and for the softening of the clinker.

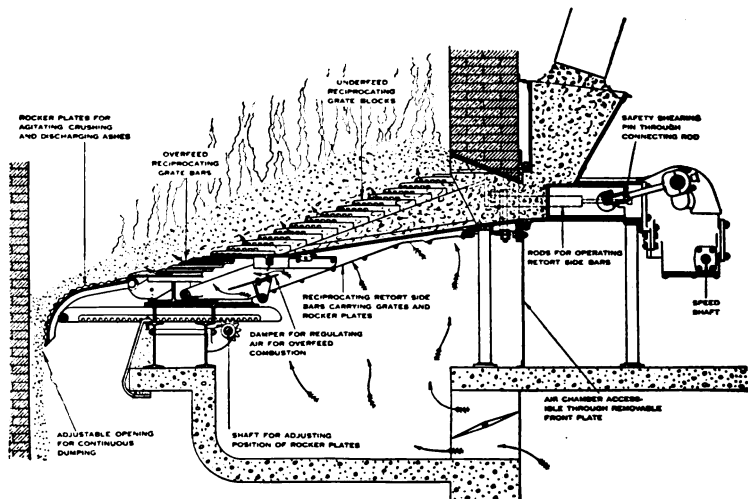
In connection with horizontal tubular boilers or water tube boilers horizontally baffled, the Murphy stoker can be installed with a flush front setting. Arrangement can be made for extended or Dutch oven settings, should this be desired.



# SANFORD RILEY STOKER CO.

WORCESTER, MASS.

BRANCH OFFICES: BOSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, BUFFALO, CLEVELAND, CINCINNATI, DETROIT, CHICAGO, ST. PAUL and BIRMINGHAM. British Licensees: Erith's Engineering Co., Ltd., London. French Licensees: Erith Leroy & Cie., Paris, France



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## THE RILEY SELF-DUMPING UNDERFEED STOKER

**Adaptability:** Applicable to any boiler either water tube or fire tube, and to heating and smelting furnaces.

**Construction:** The RILEY STOKER is made up of standardized retort units. Its unique feature is reciprocating retort sides which keep the fuel bed active, even and homogeneous. The coal feed and air supply are automatically controlled to meet load demands. The dumping of refuse is continuous and automatic. A safety connecting rod for each plunger absolutely prevents damage to stoker in case plunger is blocked.

**Flexibility:** Moving air-supplying grates break up the banked fire and instantly admit the air, giving rapid combustion. RILEY STOKERS will raise a boiler from banked fire to 250% of rating in five minutes.

**Efficiency:** Extraordinarily high efficiency at all ratings is obtained due to the complete and intimate mixture of the fuel with just the right amount of air.



**Capacity:** Due to the constant movement of the fuel bed caused by the re-

ciprocating retort sides the clinkers which ordinarily retard combustion are broken up; therefore, with RILEY STOKERS the gases are not choked and active combustion results at all times. The boiler capacity which can be obtained with the RILEY STOKER depends upon the number of retorts that can be installed. With boilers fired from one end 300 and 350% of rating are obtained during peaks. In other cases where boilers are fired by two stokers set back to back 500 and 600% of rating are possible.

### A FEW INSTALLATIONS OF RILEY STOKERS:

Massachusetts Institute of Technology  
Hartford Electric Light Co.  
Remington Arms & Ammunition Co.  
New York Central Railroad Co.  
Buffalo General Electric Co.  
Public Service Electric Co.  
Youngstown Sheet & Tube Co.  
Milwaukee Electric Railway & L'g't Co.  
Columbus Railway, Power & Light Co.  
E. I. Du Pont de Nemours & Co.  
Goodyear Tire & Rubber Co.  
American Steel & Wire Co.  
Graton & Knight Mfg. Co.  
New Haven Pulp & Board Co.  
Erie Forge & Steel Co.  
Hercules Powder Co.  
Midvale Steel Co.



# THE UNDER-FEED STOKER CO. OF AMERICA

GENERAL OFFICES: BOOK BUILDING, DETROIT

Makers of the Jones Stoker

BOSTON  
BUFFALO  
CHARLOTTE  
CHICAGO

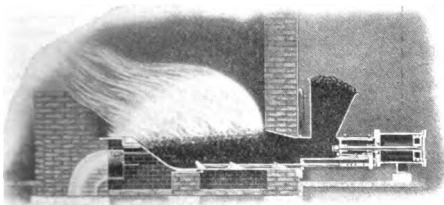
CINCINNATI  
CLEVELAND  
DENVER  
KANSAS CITY

MINNEAPOLIS  
NEW ORLEANS  
NEW YORK  
PHILADELPHIA  
PITTSBURGH

SAINT LOUIS  
SALT LAKE CITY  
SEATTLE  
TORONTO

## JONES "STANDARD" STOKER:

The operation of the Jones "Standard" Stoker is shown in the illustration below. Coal is fed to the hopper, outside the furnace wall, and is moved forward and upward by the successive action of the ram and pusher blocks. The fire is always on top and as the fresh coal is slowly pushed upward it is gradually heated until coked. The extreme simplicity of this stoker may be understood from the illustration below. Few moving parts, none in contact with the fire, explains the extremely low repair costs. The retort or fuel magazine is installed inside the furnace. It consists of a heavy casting along the top edge of which are arranged tuyere blocks through which air is supplied. An auxiliary ram or pusher rod in the bottom of the retort moves in conjunction with the main ram and insures an equal distribution of the fuel in the furnace. Because this ram is at the bottom of the retort



it is entirely covered by fresh coal when the stoker is in use. The stroke of the pusher rod may be adjusted to suit any fuel.

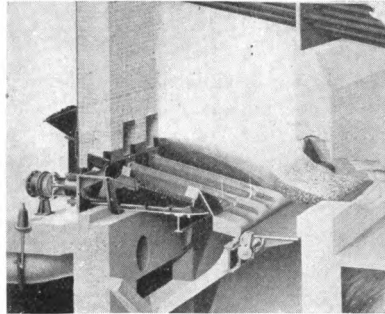
The ash accumulates on the dead plates along either side and is removed through the cleaning doors in the front. The supply of air and the supply of fuel are automatically proportioned so that high efficiency of combustion is the result. As this automatic control is regulated by the steam pressure and is immediately responsive to even the slightest variations, the steam pressure is held very even at all times.

This stoker is adaptable to any size and type of boiler and may be used under all conditions and with any grade of bituminous coal. It may be used where space limitations make impossible installations of other types of stokers. It can be installed under old boilers as well as new and, in fact, gives efficient service under all conditions.

*Write for complete "Standard" catalog.*

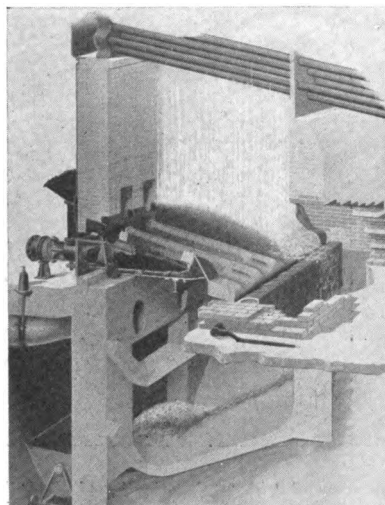
*"Pays For Itself—Then Pays Dividends"*

## JONES "A-C" STOKER:



The Jones "A-C" Stoker is the same as the Jones "Standard" Stoker except that it is self-cleaning. The ash and refuse are automatically deposited on the dump plate at the rear as shown in the above illustration. This balanced dump plate is then easily dropped by hand and the ashes are dumped into the sealed ash pit below as shown. This stoker has the same advantages as the Jones "Standard" Stoker and in addition is cleaned automatically.

*Write for complete "A-C" catalog.*



## THE UNIVERSAL AUTOMATIC UNDER-FEED STOKER CO.

JOHNSTOWN, PA.

### THE SYSTEM:

Is designed upon fundamental mechanical principles and practical knowledge of combustion. Fuel distribution, fire cleaning, and delivering ashes outside of stoker chambers are AUTOMATIC.

### THE DESIGN:

Eliminates complications. There are few moving parts, and none in the fire. Built from best known obtainable materials for durability, and not to create repair business.

### THE INSTALLATIONS:

Are readily adjustable without stoppage. Consume, separately or mixed, any grade or kind of soft coal, track scrapings, mine cuttings, boney, coke breeze or similar refuse, having enough combustible to produce its own "heat of combustion," with resulting reduction of fuel cost. Deliver over bridge walls

clean high temperature gases having B. T. U. relative to contents of fuel consumed.

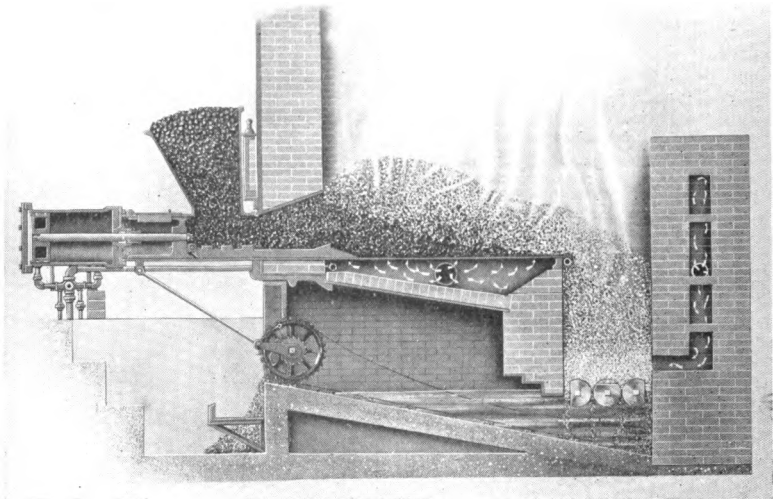
### THE EQUIPMENTS:

Are sold under guarantee of capacity and efficiency. Flexible, suitable for single boilers or the largest plants. If provided with coal and ash-handling machinery, fire room force may be reduced to one man, on a watch, for any size plant.

Manually cleaned stoker plants may, usually, be changed to OUR AUTOMATIC SYSTEM. Preventing the physical enervation due to hand cleaning fires, handling hot ashes, and save the fuel always lost doing so. With most makes we can utilize all parts of existing equipments that can be turned over to us in good order, except the stoker speed regulators and material inside of fire chambers.



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The Above Cut Shows Combination of Water Sealed Combustion Chambers, Submerged Supports and Automatic Ash Remover. Different Arrangement of Cleaning Parts, Whether for Submerged, Dampened or Dry Ash, Are Made, or, if Space under Boiler Admits, Steam Jet Conveyor May Be Substituted, as Most Suitable

# FLYNN & EMRICH COMPANY

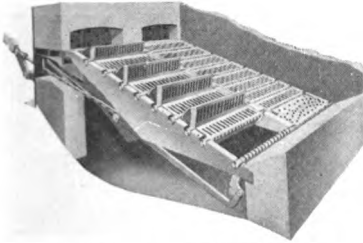
BALTIMORE, MARYLAND

**Exclusive Manufacturers of the Huber Hand Stoker**

Representatives in all of the principal cities in the United States

## THE HUBER HAND STOKER:

Sold by contract in which are incorporated the following guarantees:



**The Huber Hand Stoker**

Evaporate 10 pounds and over of water per pound of coal.

Develop an overall efficiency of 70% and over.

Increase capacity of the boiler from 25 to 75%.

Eliminate smoke so as to conform with the most rigid smoke laws in any of our cities.

(The above are based on the use of coal containing 14,000 B. t. u.'s and volatile matter not in excess of 20%.)

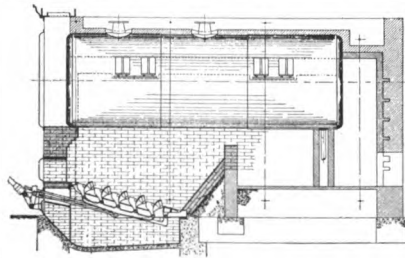
In practice this means that the boiler plant can be run at full and over-rated capacity continuously, day and night, without having to drop the steam pressure for the periodical cleaning of fires. This is made possible by the automatic fire-cleaning feature incident to the HUBER HAND STOKER operation.

The very poorest grades of fuel that give endless trouble when burned on other types of stokers or grate bars can be

burned with the greatest satisfaction on the HUBER HAND STOKER.

The HUBER HAND STOKER can be installed without making any change in the present boiler construction or setting and in a space of a day or so.

With the HUBER HAND STOKER there is no complicated mechanically driven mechanism to get out of order and cause trouble and expense, but a STOKER that is manufactured and installed with three distinct objects in view: **Simplicity, Durability and Efficiency.**



**Horizontal Return Tubular Boiler Equipped with the Huber Hand Stoker**

101

In brief, in making an installation of the HUBER HAND STOKER there is obtained the efficiency, overload and all other desirable qualities found in the best types of automatic stokers at about one-fourth or one-fifth the cost; and devoid of the troublesome features and the big cost of upkeep incident to the installation and operation of automatic stokers.

*The services of our Engineering Department are gratis.*

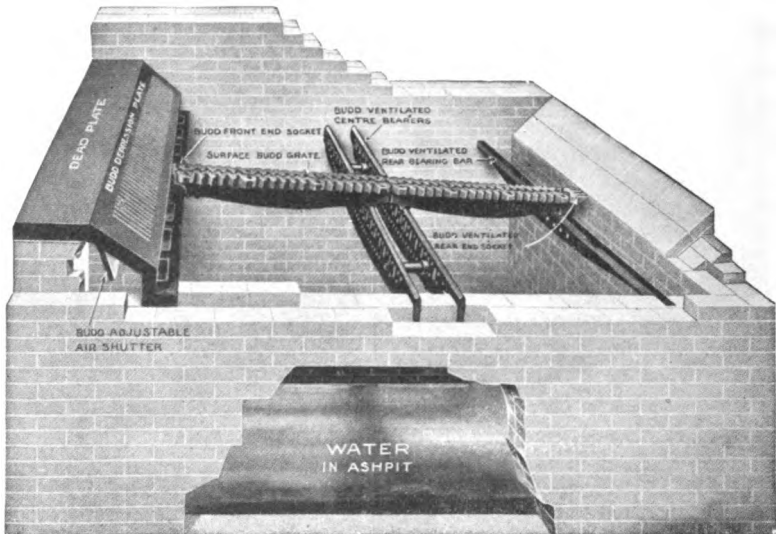
## THE BUDD GRATE COMPANY

OFFICES: 2013 E. LETTERLY ST., PHILADELPHIA, PA.

WORKS: ADAMS TO LETTERLY STS.

Manufacturers of Budd Boiler and Furnace Equipment

Aluminum, Iron and Brass Foundries. Machine and Pattern Works



102

### THE BUDD STATIONARY GRATE AND EQUIPMENT (PATENTED):

The above cut illustrates the Budd Equipment. Observe that the grates are placed at sufficient distance from the ends of the bearing bars and depression plate as to allow for the bearing bars to be bricked in the side walls.

Budd Arches are made special and will therefore fit any firebox. The centre pier, the casting between the two side piers and which is placed on the dead plate, is not cast solid but is made of metal 2 inches or thicker, when required, and the inside of the same is hollow, which naturally gives ventilation and acts as a preventative to the heat. The side liners or side piers are also ventilated as shown. The arch in the above cut is cast in two pieces, effecting ease in installation. The heavy rib on the arch acts as a reinforcement and when installed is embedded in the bricks and this does not bring it in direct contact with the fire.

A rib is also cast on the under side of the dead plate. It cannot be seen in the above cut. All the Budd Dead Plates

have this rib, insuring long life, non-warping and non-twisting.

The Budd Depression Plate admits the air at an angle and diverts the heat from the boiler front doors and liners, protecting the fireman. By admitting the air at this angle the heat is applied directly to the boiler or tubes and accomplishes results in steam, and increases the air inflow without increasing the firebox space and will burn the smoke. The Depression Plate is equipped with an air shutter operated from the front of the boiler, when it is found necessary to control and regulate the inflow of air.

In the Budd Patented Grates in the above cut each individual bar is made of the standard width of  $2\frac{1}{2}$  inches and they are shown inserted in the front and rear end sockets and each pair is resting side by side along the bearing bars and the depression plate. Budd Grates are made of the same design for all kinds of fuels although *different patterns are used of various openings so as to meet any fuel condition.*

Send for copy of "Boiler Furnace Operation," a concise handbook.



## McCLAVE-BROOKS COMPANY

MAIN OFFICE AND WORKS, SCRANTON, PA.

NEW YORK OFFICE  
50 Church St.

PHILADELPHIA OFFICE  
400 Morris Bldg.

CHICAGO OFFICE  
515 Hearst Bldg.

Manufacturers of McClave's Stoker, McClave's Shaking, Cut-Off and Dumping Grates, McClave's Argand Steam Blower. All Kinds of Iron and Brass Castings

### McCLAVE'S SHAKING, CUT-OFF AND DUMPING GRATES:

Made in four different types: Nos. 1 and 2 being used principally for soft coal and the larger sizes of Anthracite; Nos. 3 and 4-A for the smaller Anthracite sizes.

**McClave Grate No. 1** is our old type

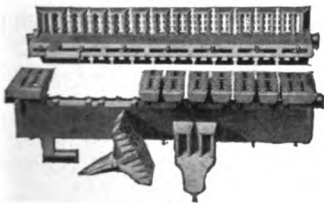


**McClave Grate No. 2**

of Shaking and Cut-off Grate, in which all of the grate bars are cast integral.

In our new type, **No. 2**, the regular grate bars are made with *Removable Sectional Tops*, with shanks which are mounted in sockets in the pendant body portion of the bars. Cost of repairs is thus reduced to a minimum. These grates have an absolute cut-off movement, in which each row or section can be operated as a whole, or the front and rear separately. In the shaking movement there is no increase in the openings between bars, consequently no waste of unconsumed fuel.

**McClave Grate No. 3.** Specially adapted to burn the smaller sizes of Anthracite fuel, such as Buckwheat, Birdseye, Rice, etc.

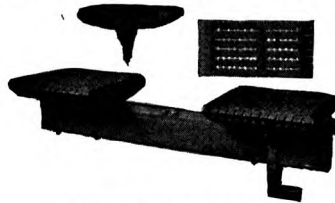


**McClave Grate No. 3**

The Grate Bars are constructed with a body portion and *Removable Sectional Tops*, the shanks on the tops being arranged centrally, which makes practically a "T" formation, whereby a double cut-off movement is secured by forming

pockets on either side of the bars. Each row can be operated as a whole, or the front and rear separately.

**McClave Grate No. 4-A:** This is a dumping grate, specially designed to burn the smaller sizes of Anthracite coal. Sectional Removable Tops are made with beveled edges at end, to allow for expansion. Overlapping of edges of bars



**McClave Grate No. 4-A**

prevents sifting between the bars. Fitted with twin levers for operating the front and rear series of bars separately.

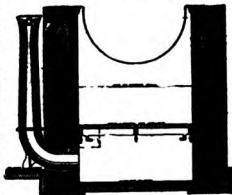
103

The mesh or air space in the tops is made as small as  $\frac{1}{8}$ " for the very small sizes. The construction as a whole is very strong and durable.

Grate frames are made in one or more rows, as required, with expansion top Journal Bearing Bars reaching from the front to rear of furnace, and having Journal Locks which fit over the journals of the Grate Bars, to prevent the bars from lifting out of their bearings when they are being operated.

### McCLAVE'S ARGAND BLOWER:

The result of over thirty-five years' experience with the problem of more effectually burning the cheaper grades of Anthracite and Bituminous fuels. Gives a properly proportional combined air and steam blast, and forms a complete system when used in connection with McClave Grates.



Large volume of air with small steam consumption guaranteed. Practically noiseless in operation. Automatic Blower Regulator also furnished when desired. Illustration shows new type High Duty Blower installed through side wall of boiler.

## THOMAS GRATE BAR CO.

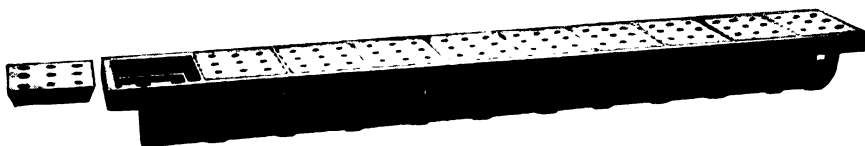
BIRMINGHAM, ALA.

BRANCH SALES OFFICES

Hippodrome Building, CLEVELAND, OHIO  
50 Broad St., NEW YORK

Railway Exchange Building, CHICAGO, ILL.  
612 Hibernia Bank Bldg., NEW ORLEANS, LA.

Manufacturers of Thomas Elliptic Grate Bars for Every Fuel and Every Condition

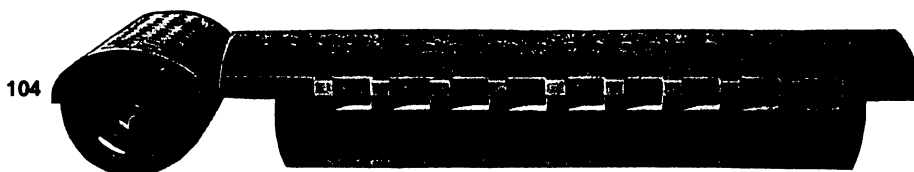


### 8-INCH IMPERVIOUS GRATE BAR (PERFORATED $\frac{5}{8}$ INCH OR $\frac{7}{8}$ INCH)

**TROUBLE BEARERS**—Have blocks recessed and filled with Impervious Fire Sand Cement, protecting the grate bar from the heat of the furnace with approximately one inch of cement which withstands 3400° F.

Made for all hard places burning wood refuse, sawdust, hogged fuel and shavings with natural, induced, forced draft and hollow blast grates, where there is trouble from dirt or glass clinker, or burning out of intermediate bars.

**WILL OUTLAST FIRE CLAY BRICK FURNACES.**

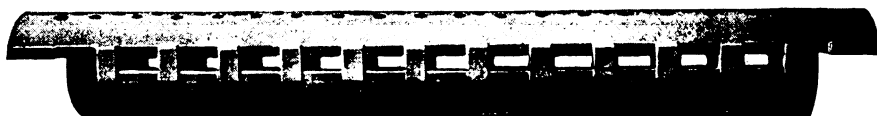


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### 8-INCH JUMBO (PERFORATED $\frac{5}{8}$ INCH OR $\frac{7}{8}$ INCH):

For Dutch Ovens, Burning Hogged Fuels and Sawdust.

**STEAM PRODUCERS**—Contain 16% more grate surface in the same area. The correct way to burn wood refuse.



### 6-INCH ELLIPTIC (PERFORATED $\frac{5}{8}$ INCH):

For Burning Saw Dust and Mill Refuse.

**STEAM PRODUCERS**—Contain 20% more grate surface in the same area. Get the heat units from the sawdust.

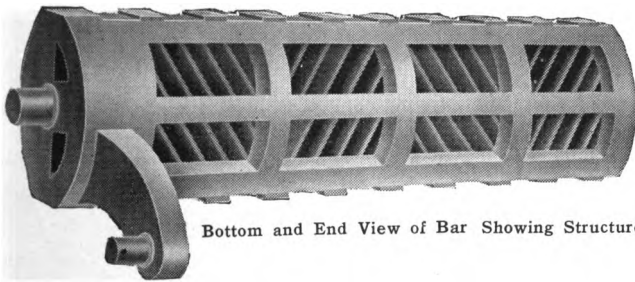


### 6 AND 8 INCH ELLIPTIC (CROSS RIB):

For Burning Wood, Trash, Coal and Mixed Fuels.

**STEAM PRODUCERS**—You can't stop up a single opening by firing, slabs, blocks, planks, or wood—keep clean fires.

# THOMAS GRATE BAR CO.



Bottom and End View of Bar Showing Structure

## THOMAS WIGGLING-SHAKING-DUMPING GRATE BARS:

### Fitted to Every Type of Boiler.

Water Tube	} in {	Power Plants
Return Tubular		Locomotives
Scotch Marine		Steamships
Marine		Dredges
Dog House		Steam Shovels
Locomotive		Skidders
Vertical		Loaders

A Bar for every condition and manipulated to suit every fuel.

**Fire without Having a Cleaning Period on**

THOMAS



GRATE BARS

Save their cost in fuel in a few weeks' use.

Eliminate the cleaning period.

Eliminate grate bar mishaps and shut-downs.

Make a poor steaming boiler a free steamer.

Reduce the fireman's labors.

Cannot get out of fix and refuse to work,

### Structure:

Is made up of two curves, one top and one bottom, joined together at each side with spacing and connecting lugs of one-third contact and two-thirds air space forming a structure in which the heat cannot equalize; the under portion cannot get hot to break or become distorted and refuse to work.

105

### Material:

Made of pure Pig Iron (no scrap) bought on analysis, standing 2370 degrees before fusing.

### Operation:

The Elliptic shape, eccentric movement slips under the fuel or fire bed, peels the ash from its lodgment and deposits into ash pit and does not disturb the fire, tearing the fuel bed into streaks, seams, holes and pockets, as other shaker grates do.

### Results:

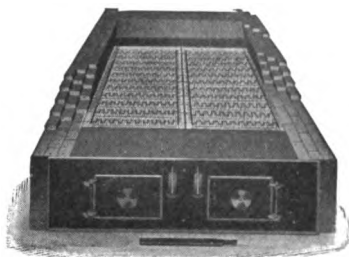
The fire is kept at the highest state of efficiency at all times—never fouling, giving more steam and substantial savings in fuel.

**For Use with Either Natural, Induced or Forced Draft.**

## MARION MACHINE FOUNDRY & SUPPLY CO.

MARION, INDIANA, U. S. A.

Manufacturers of Shear-Klean Grates, Scottdale Grates, Marion Hand Stokers, Marion Planet Soot Blowers, Marion Duplex Soot Blowers, Marion Rotary Soot Blowers, Alexander Patent Water Gauges, Boiler Fronts, Castings, etc.



Shear-Klean Grate

### SHEAR-KLEAN GRATES:

106 The Shear-Klean Grate is designed for burning low grade clinkering coals efficiently. In addition to the rocking movement it has the sidewise movement which breaks up the clinker. This quadruple movement cleans the fires and does not waste the fuel.

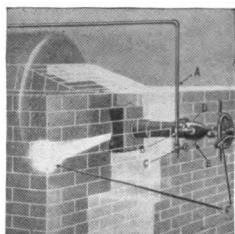
It is an extremely heavy grate with deep webs and deep teeth. Always cool and never warps. Made of the very best iron and fully guaranteed.

### SCOTTDALE GRATES:

This is a Rocking and Dumping grate. Sift out the ash by rocking. Remove the clinker by dumping.

### MARION HAND STOKER:

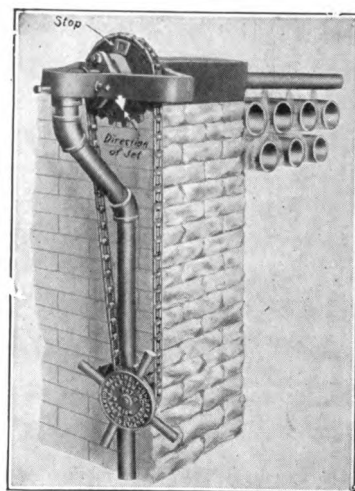
Designed to meet the most rigid smoke ordinance. Burns coal efficiently and will keep a clean stack. Efficient, easy to use, and will give a smokeless furnace.



Marion Rotary Soot Blower

### MARION ROTARY SOOT BLOWER:

A reliable, and efficient rear end Soot Blower for H. R. T. boilers. Thousands in daily use.



Marion Planet Soot Blower

### MARION DUPLEX SOOT BLOWER:

A front end soot blower that does a perfect job of cleaning, quickly and easily. Always ready for use and never in the way.

### MARION PLANET SOOT BLOWER:

This blower can be used on every type of water tube boiler. Patented internal welded nozzles. Hand wheel operation. Perfect control and easy to operate.

Send for 68-page catalog on Marion Power Plant Equipment. Complete text book on Combustion and Soot. Free.

## FULLER-LEHIGH COMPANY

(Successor to Lehigh, Car, Wheel & Axle Works)

FULLERTON, PENNA., U. S. A.

**Manufacturers of Pulverized Coal Equipment, Crushers, Dryers, Car Wheels and Axles, Chemical Castings, Special Castings in Green Sand or Loam, Etc.**

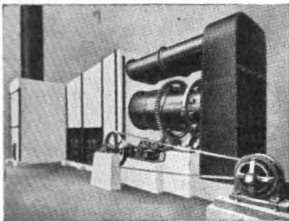
### **PULVERIZED COAL EQUIPMENT:**

**Superior in  
Design Efficiency Performance**



Lehigh Crushing Rolls

We are in position to furnish all the various units used in connection with furnaces heated by means of pulverized coal. At the present time our Pulverized Coal Equipments, consisting of Lehigh Crushing Rolls, Indirect Fired Rotary Dryers, Fuller-Lehigh Pulverizer Mills, Pulverized Coal Feeders, and Fuller Quality Sprocket Wheels, are in-



Indirect Fired Rotary Dryer

stalled in plants having a capacity of 25,000 tons of pulverized coal per day. These plants are widely distributed and



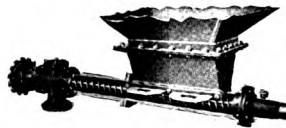
Fuller Mill,  
Pulley Driven



Fuller Mill,  
Gear Driven

are pulverizing coal obtained from a large number of fields in various coal-producing districts.

The types of furnaces heated with Pulverized Coal are quite diversified, and we enumerate here some of the furnaces at present heated by means of this most economical and efficient fuel in order to convey some idea of the wide application of Pulverized Coal for heating various types of Industrial Furnaces.



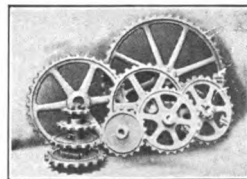
Pulverized Coal Feeder

Annealing Furnaces  
Bar Heating Furnaces  
Billet Heating Furnaces  
Calcining Furnaces  
Drying Furnaces  
Forge Furnaces  
Locomotives  
Nodulizing Furnaces  
Open Hearth Furnaces  
Ore Roasting Furnaces  
Piled Scrap Heating Furnaces  
Puddling Furnaces  
Rotary Cement Kilns  
Rotary Lime Kilns  
Steam Boiler Furnaces, Marine and Land Type

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*Send for Illustrated Catalogue No. 71.*

Face  
Hardened  
Sprocket  
Wheels



## **PULVERIZED FUEL EQUIPMENT CORP.**

30 CHURCH ST., NEW YORK

FOREIGN AGENCY: INTERNATIONAL PULVERIZED FUEL CORPORATION  
TRANSPORTATION BUILDING: MONTREAL

### **FUEL PREPARING PLANT:**

We deliver in operation, complete fuel preparing, distributing, feeding and burning installations for locomotives, stationary and marine boilers, metallurgical and chemical furnaces and cement kilns.

As each installation involves distinct problems every plant is designed to meet local fuel, operating, and production conditions, thereby insuring the most successful results.

### **FEEDING EQUIPMENT:**

Standard "Lopulco" Feeder, as illustrated, insures against clogging and flooding; and provides uniform delivery and positive mixture of requisite fuel and air for quick ignition and temperature regulation. Eliminates pulsation and produces steady short flame at burner outlet resulting in complete combustion and less fuel consumption. Individual feeder capacities range from 50 to 4000 lbs. per hour.

108



We make a thorough study of each installation.

### **DISTRIBUTING SYSTEM:**

Universally used Screw Conveyors and Bucket Elevators, when handling pulverized fuel, require the minimum power for operation and the least cost for upkeep.

Lopulco Distributing Systems meet all requirements of insurance underwriters.

### **BURNERS:**

Several types of "Lopulco" burners have been developed to meet every operating requirement and make coal as easy to handle as oil or gas. By producing a soft and less gassy heat, furnace, boiler and shop output is increased.

*Send for our Bulletins and Engineering Inquiry Sheets and let us give you preliminary information.*



## QUIGLEY FURNACE SPECIALTIES COMPANY, INC.

MAIN OFFICE: 26 CORTLANDT ST., NEW YORK CITY

BRANCH OFFICES:

Munsey Bldg.  
BALTIMORE

Ellicott Square  
BUFFALO

Oliver Bldg.  
PITTSBURGH, PA.

Real Estate Trust Bldg  
PHILADELPHIA  
Dry Milling Engineering Co.  
DENVER, COLO.

**Engineers, Designers and Contractors of Complete Powdered Coal Equipments  
Including Furnaces**

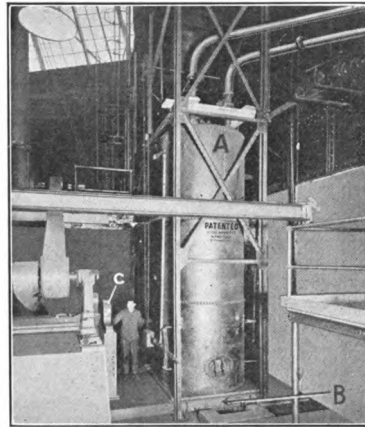
**Also Makers of HYTEMPITE Furnace Cement**

### QUIGLEY PATENTED SYSTEM OF POWDERED COAL EQUIPMENT:

With our improved method of burning powdered coal, the fuel is automatically weighed as sent to the furnace bins. Transportation of the fuel is through wrought pipes to the furnace bins which may be in widely separated departments.

The system of distribution consists of pipes with switching valves conveniently located, the turning of which diverts the coal to bin or bins as desired. These bins are located at the furnaces with an ample fuel supply for 10 to 24 hrs. The controller used to regulate the fuel feed is of simple design having only two working parts but is positive in action. By turning a hand or chain wheel, absolute control of fuel fed to burners is obtained.

The fuel is fed by the controller through a moving screen into a low pressure air system which carries the fuel into the burner where it is mixed with the larger volume of combustion air at a pressure just above atmosphere, thus securing the lowest velocity and most perfect combustion.

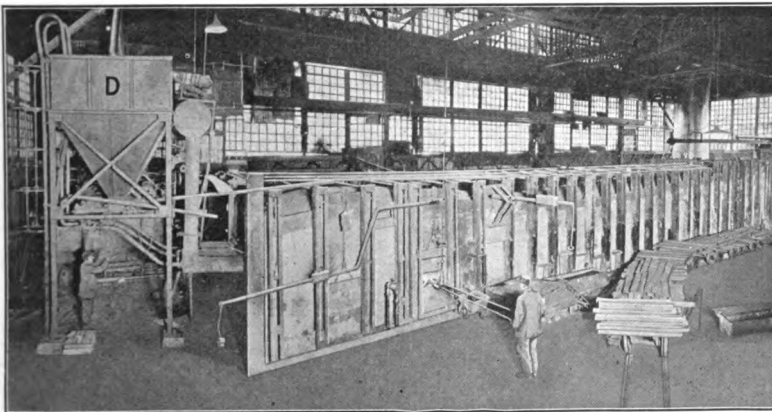


**Powdered Coal Blowing Tank**

A—Blowing Tank  
C—Scale Dial

B—Scale Platform  
D—Furnace Bin

*Send for Bulletin No. 11 describing  
complete system with illustrations of plants  
now in successful operation.*



**70 Foot Billet Heating Furnace**

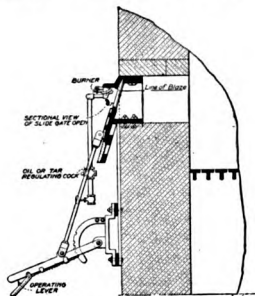
## W. N. BEST, INC.

11 BROADWAY, NEW YORK

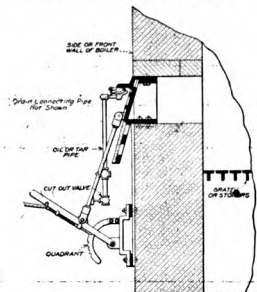
**Engineers in Caloric: Liquid Fuel Equipment; Furnaces for Heating, Melting and Heat Treatment of Metals. High Pressure, Low Pressure, Volume Air, Air Carbureting and Mechanical Burners of All Sizes**

### W. N. BEST CALOREX EQUIPMENT:

MAKE YOUR POWER PLANT DEPENDABLE. IF YOU ARE AT PRESENT BURNING COAL, INSTALL OIL AT ONCE AS AN EMERGENCY FUEL, AS A CERTAINTY FOR MEETING PEAK LOADS WITH THE CALOREX EQUIPMENT.



Burner in Position for Use



Burner Shut Off and Opening in Furnace Wall Closed

For burning oil or tar in combination with coal in either hand-fired or stoker-fired boilers, or in bagasse-fired boilers using oil exclusively or coal exclusively, or bagasse exclusively; or can be used to quickly double or triple the rating of the boiler by using the oil or tar in combination with coal, breeze or bagasse. Simple of operation. Easily installed. Any man of ordinary intelligence can learn to operate it in ten minutes.

We believe no power plant in which coal is used as a fuel is safe today without liquid fuel equipment for use either in combination with coal (where coal is cheap and the oil is high) or for the use of oil exclusively as fuel when necessity

demand. The use of liquid fuel elevates the mind of the fireman, for it is a science, while the burning of coal necessitates brawn rather than brains. This fuel also gives the man in the boiler room confidence, for he knows his ability to meet the fluctuating loads, no matter what may be the climatic conditions, winter or summer.

In many power plants the W. N. Best Calorex Liquid Fuel System is used in combination with coal to carry the peak loads demanded of the boiler, a few hours in the morning and for a few hours in the afternoon or whenever the power is intermittent. This invention, lately patented by Dr. W. N. Best, is a model of simplicity, durability and efficiency in securing and maintaining  $CO_2$  from the fuel in the firebox of boiler when burning oil exclusively or when burning coal in combination with oil. If it is desired to operate the boiler with coal only, the flow of oil through the burner is stopped by the operating valves as shown in cut, and the slide gate is closed which can be done in a quarter of a minute. The air for combustion is admitted below the sheet of flame immediately under the burner in the accurate, regulated quantities required for the perfect combustion of the oil. The air damper can be so regulated by the lever on the quadrant as to insure accurate regulation either at maximum or minimum capacity.

In gas works where considerable water-gas tar is made as a by-product, with this invention this is a very superior fuel because of its high calorific value when thoroughly atomized. This tar can be burned either in combination with the coal or breeze, or can be used exclusively as fuel. When the supply of tar is exhausted, the burner is shut off by means of the valves and the slide gate is closed, which hermetically cuts off the outer air as well as seals the opening in the side wall of the boiler, after which coal can be burned in the boiler exclusively in the usual manner. When a supply of tar has again accumulated, the burner may be again operated in the usual manner.

**CALOREX**

We have some interesting literature we will send gratis.



## HAMMEL OIL BURNING EQUIPMENT COMPANY, INC.

**SALES OFFICE:**  
12 Pearl Street  
BOSTON, MASS.

**MAIN OFFICE:**  
PROVIDENCE, R. I.

**SOUTHERN AGENCY:**  
Dixie Mill Supply Co.  
NEW ORLEANS, LA.

OFFICES IN NEW YORK, BOSTON, PROVIDENCE AND PORTLAND, ME.

### Products:

HAMMEL OIL BURNERS; HAMMEL PATENT OIL BURNING FURNACES; OIL PUMPING SETS.

Also, Hammel Special Designed Oil Burning Furnaces; Hammel Oil Firing Valves; Automatic Pump Governors; Oil Strainers; Fuel Oil Heaters; Oil Burner Governors and Draft Gages.

### HAMMEL OIL BURNERS:

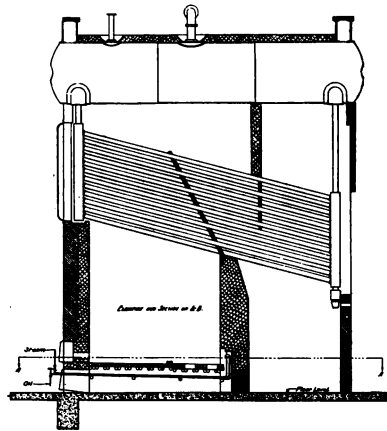
The Hammel oil burner is of the inside mixer type and built upon scientific principles. The features which distinguish the Hammel as an ideal oil burner are that, in normal service, it will not carbonize; parts subject to wear, due to grit in oil, can be easily renewed; heavy Mexican oil is burned with perfect results.

### THE HAMMEL OIL BURNING FURNACES:

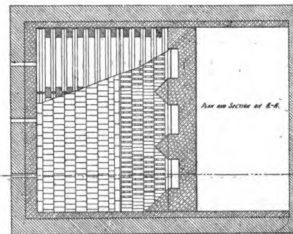
The proper design of furnace is of supreme importance as determining the efficiency and capacity of boiler, and immunity from boiler injuries and shut-downs. Brick arches, bridge walls and target walls are not only needless in securing high boiler efficiency, but are a menace to the continuity of operation. The Hammel Company, after years of experimenting and diligent study, have developed oil burning furnaces for the different types of steam boilers, which not only eliminate the defects encountered in the ordinary improvised furnaces, but represent the highest development so far attained in this particular branch of engineering.

The Hammel patented furnaces for the Babcock & Wilcox and Stirling boilers, and the Hammel patented double burner system for locomotives, also the Hammel special designed furnaces for Return, Tubular, Scotch Marine, Locomotive, and the various types of water tube boilers, when provided with the Hammel Oil Burner, make an unbeatable combination.

The Hammel Patent Oil Burning Furnace as applied to the Babcock & Wilcox and Stirling water tube boilers represents the most important advance yet made in burning oil under boilers of this character. It enables these boilers



111



The Hammel Patent Oil Burning Furnace

to be operated at a considerable increase in capacity and economy without smoke or burning of tubes. The results shown have not been equalled by any other system.

### ADVANTAGES OF THE HAMMEL OIL BURNING FURNACES:

- Greater economy.
- High efficiency.
- Ability to develop greater overloads.
- Perfect combustion.
- Furnace upkeep cost reduced to a minimum.
- Simplicity of construction.
- More even distribution of the heat.

## A. M. LOCKETT & CO., LTD.

Contracting Mechanical Engineers

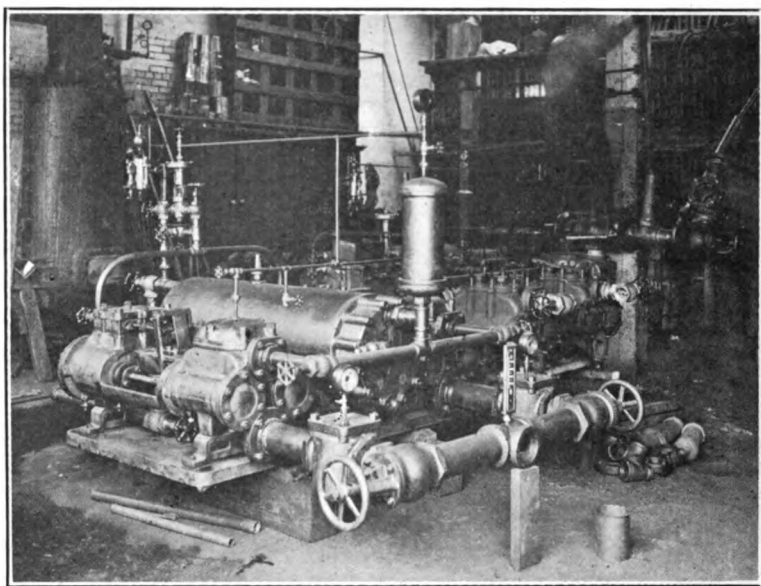
521-523 BARONNE, NEW ORLEANS

HOUSTON, TEXAS

FORT WORTH, TEXAS

**Manufacturers of Oil Burning Apparatus and Automatic Fuel Oil Pumping Sets**

112



Illustrating Lockett Automatic Oil Set for 6000 H. P.

We have standard equipment for plants ranging from 100 to 10,000 boiler H. P., and are prepared to furnish complete oil burning equipment and to furnish plants or erect same when desired.

**OIL PUMPING SETS:** Lockett Automatic Oil Pumping sets have been on the market for sixteen years and have thoroughly proved their reliability and effectiveness for supplying oil to burners at uniform pressure and temperature.

Each part of these outfits is carefully selected and designed for the service it is to perform and our Porcupine type of heaters is particularly adapted to heating the heavier grades of crude oil.

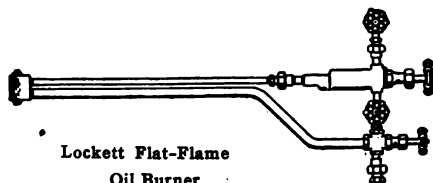
Write for "Lockett Bulletin No. 103."

**OIL BURNERS:** The Lockett Flat-Flame Oil Burner is the result of several years' development in a burner particu-

larly adapted to burning heavy grades of crude oil and residuum. This burner is fitted with our patented oil regulating valve which makes regulation sensitive and is particularly useful when handling dirty or heavy oil. The burner has a number of other features of design which makes it simple to clean and manipulate and very economical in the use of steam for atomizing.

We manufacture also other types of burners for special requirements.

We have agencies in New York, Cuba, Porto Rico and Mexico.



Lockett Flat-Flame  
Oil Burner

## M. H. DETRICK CO.

549 W. WASHINGTON ST., CHICAGO, ILL.

Manufacturers of Flat Suspended Fire-Tile Arches

### DISTRICT SALES OFFICES

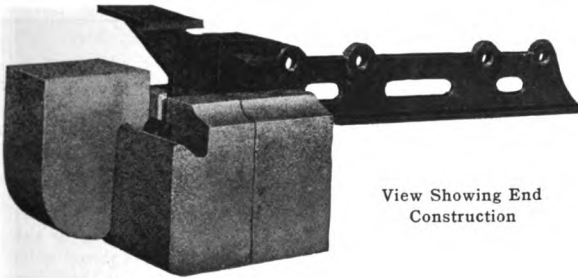
CHICAGO   MILWAUKEE   ST. LOUIS   DETROIT   CINCINNATI   CLEVELAND   NEW YORK  
PHILADELPHIA   PITTSBURGH   BOSTON   INDIANAPOLIS   SALT LAKE CITY   NEW ORLEANS   BUFFALO

### DETRICK   FLAT   SUSPENDED ARCHES:

Applied to All Types of Boilers and  
Stokers

The end construction shown in the accompanying view is a unique feature in providing the following essentials:

1. Practical apron wall support.



View Showing End  
Construction

113

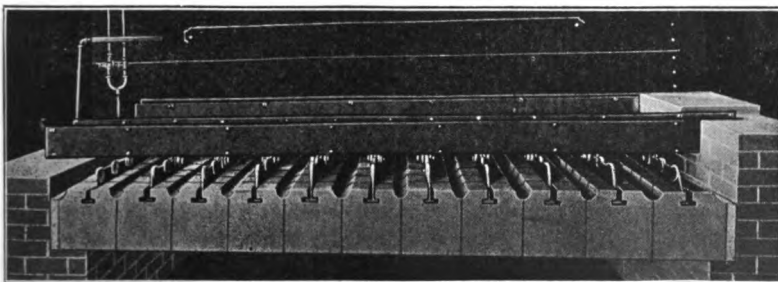
The freely suspended individual tiles can move under expansion stress, thereby relieving the side walls from side thrust entirely. Tiles may be removed and replaced without disturbing the balance of the construction. The flat under surface provides a more uniform distribution of the gases and maintains a higher temperature for the burning of the mixture of air and volatile gases.

2. Flexible construction, allowing easy repairs.

3. Unit system of suspension.

There is a reason why over 1,000,000 boiler horse power are equipped with **Detrick Flat Suspended Arches**.

*Descriptive Literature  
on request.*



Front View Showing Application of Detrick Flat Suspended Arch to Chain Grate Stoker

## CELITE PRODUCTS COMPANY

NEW YORK  
11 Broadway

CHICAGO  
Monadnock Bldg.

PITTSBURGH  
Oliver Bldg.

LOS ANGELES  
Van Nuys Bldg.

SAN FRANCISCO  
Monadnock Bldg.

Producers of SIL-O-CEL for Insulation of Heat and Cold, Fireproofing and Sound Deadening

### DESCRIPTION:

Sil-O-Cel Insulating Brick, Powder and Cements possess unusual heat insulating qualities, due to their light weight and cellular nature. Made from Celite, Sil-O-Cel is almost pure silica, making it possible to subject it to temperatures which would entirely destroy other forms of insulation.

### APPLICATION:

Following is a partial list of high temperature equipment successfully insulated with Sil-O-Cel:

Boiler Settings.	Waste Heat Boilers.
Hot Blast Stoves.	Hot Blast Mains.
Bustle Pipes.	Hot Metal Cars.
Ladles.	Dust Catchers.
114 Coke Ovens.	Metal Mixers.
Soaking Pits.	Spelter Pans.
High Temperature Flues.	Melting Pots.
Ingot Molds.	Kilns.
Regenerators.	Electric Furnaces.
Gun Furnaces.	Annealing Furnaces.
Annealing Pits.	Malleable Furnaces.
Crucible Furnaces.	Enameling Ovens.
Japanning Ovens.	Bakers' Ovens.
Core Ovens.	Dryers.
Gas Generators.	Gas Producers.
Coal Gas Benches.	Oil Stills.
Marine Boilers.	Pipe Covering.
	Glass Equipment.

### SIL-O-CEL INSULATING BRICK:

Sizes are 9 x 4½ x 2½ inches. Arch, splits, and soap brick are carried in stock. Sil-O-Cel Brick weigh 1¾ lbs. each, or about 30 lbs. per cu. ft. Crushing strength is over 400 lbs. per sq. in.

### SIL-O-CEL INSULATING POWDER:

Recommended for heat insulation where it is impractical to use brick. When properly packed, vibration or heat will not cause settling or shrinkage. It is sufficiently elastic to absorb strains incident to expansion or contraction between brickwork and shell.

## SIL-O-CEL

MADE FROM CELITE



TRADE MARK

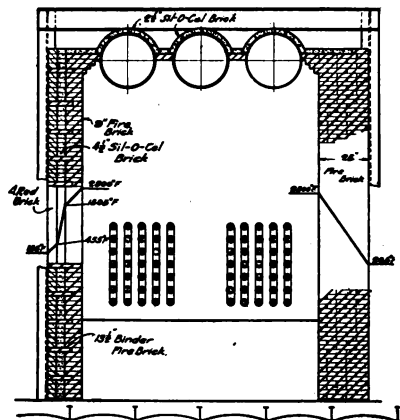
### SIL-O-CEL INSULATING CEMENT:

Used for insulating irregular heated surfaces, such as flues, breechings, boiler drums, etc. Applied in three forms, first, a sticking coat, second, the insulating coat, third, a hard finish coat. This cement possesses good insulating value and is more refractory and durable than the usual insulating mixture.

### HOW SHIPPED:

Sil-O-Cel Insulating Brick are packed in crates of 25 brick each, and, owing to lightness, brick can be readily handled on the job with great saving in labor.

Sil-O-Cel Powder is shipped in burlap bags of convenient size for handling. Bags are returnable for full credit in good condition at the mill at Lompac, California, freight prepaid, if shipped within 90 days.



Section through Boiler Setting

Showing insulated and uninsulated wall and application of Sil-O-Cel.

### INFORMATION:

Detailed information on any specific heat insulating problem will be gladly furnished by our Engineering Department.

# **CRESCENT REFRACTORIES COMPANY**

**CURWENSVILLE, CLEARFIELD COUNTY, PENNSYLVANIA**

PLANTS—CURWENSVILLE, PA.—LUMBER, PA.—CLEARFIELD, PA.

**Manufacturer of Fire Clay Brick, Linings, etc.**

## **HIGH GRADE CLEARFIELD COUNTY**

### **FIRE CLAY REFRACTORIES:**

#### **BRANDS:**

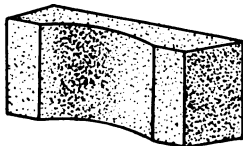
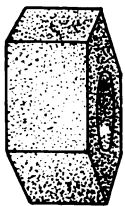
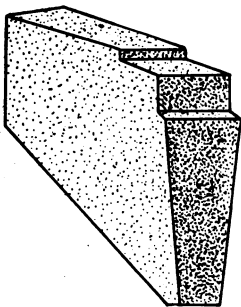
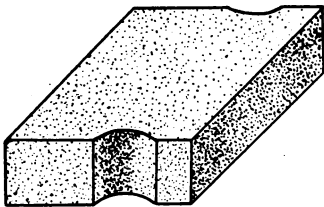
"Crescent"

"Lumber City"

"Liberty"

"Ford"

"Bick"



#### **CAPACITY:**

275,000 Nine-Inch equivalent daily.

## **PRODUCTS:**

Blast Furnace Linings  
Boiler Settings  
Brass Furnace Materials  
Calcined Flint Clay Grog and Dust  
Cement Cooler Linings  
Cement Rotary Linings  
Clinker Rotary Linings  
Coke-Oven Regenerators  
Core Oven and Annealing Furnace Brick  
Crucible Furnaces  
Crude Crushed Flint and Soft Clays 115  
Enameling Furnace Linings  
Forge Furnace Linings  
Gas Producer and Flue Linings  
Glass Furnace Regenerators and Lehrs  
Heating Furnaces, clay refractories only  
High Duty Special Shapes  
Hot Blast Stove Linings  
Iron Cupola Linings  
Ladle Liners  
Malleable and Air Furnace Materials  
Open Hearth Regenerator Materials  
Puddling and Busheling Furnace Brick  
Refractory Ground and Batch Clays  
Soaking Pit Materials  
Stove and Furnace Pipe Linings  
Vertical and Rotary Lime Kilns

## JOINTLESS FIRE BRICK CO.

1130 TO 1150 CLAY ST., CHICAGO, ILL.

NEW YORK OFFICE: 110 W. 40TH ST.

We warehouse our material in all principal cities for prompt delivery

### END YOUR BOILER TROUBLES:

# PLIBRICO

#### A High Grade Refractory

1. It's jointless.
2. It's plastic.
3. It's air and gas tight.
4. It will stand 3100° F.
5. It will save fuel.
6. It can be installed by inexperienced labor.
7. It will outlast fire brick.
8. It can be used in any boiler-furnace or oven.
9. It can be used wherever fire brick is used.
10. It cannot be equaled for patching.

INSTEAD OF first baking fire bricks and laying them up with fire clay joints,

WE APPLY our putty form PLIBRICO (fire brick material), shape it not less than 4½ inches thick, and then bake it out in a one-piece monolithic vitrified finished



#### Showing How Easy It Is Installed

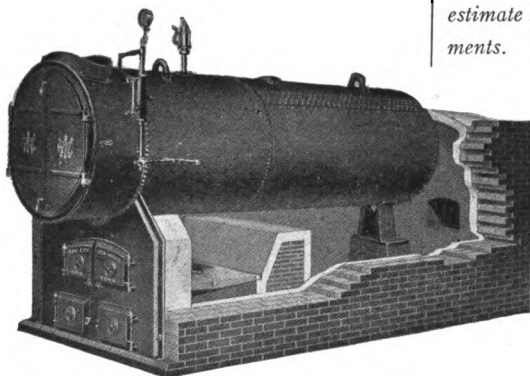
furnace lining without any joints, and making the fire brick setting air and gas tight.

ANY ENGINEER can see the economy and efficiency of such a lining.

*IT PUTS your boiler in "Class A-1."*

Try Plibrico on your front door arches and bridge walls or side walls, and we are certain that the economy demonstrated will induce you to use PLIBRICO wherever possible in your plant.

*Write for our book and send us your blue prints so that we may estimate on your furnace requirements.*



## QUIGLEY FURNACE SPECIALTIES COMPANY, INC.

26 CORTLANDT ST., NEW YORK

Manufacturers of HYTEMPITE Furnace Cement  
Also Quigley System of Powdered Coal Equipment

### THINGS YOU SHOULD KNOW ABOUT HYTEMPITE

#### What is it?

HYTEMPITE is a scientifically compounded refractory plastic material for bonding fire brick and for kindred uses.

#### What does it do?

HYTEMPITE forms a lasting union between the materials to be joined, sets at normal temperatures and retains its strength regardless of the heat it is subjected to up to about 3000° F. or a temperature at which the best quality fire brick loses its strength and becomes soft.



In the Power Plant: Hytempite for Laying up Boiler Settings



In the Foundry: Lining Cupola Spout and Ladle with Hytempite

#### Why is it better than fire clay?

HYTEMPITE is better than fire clay because fire clay and water has no binding strength, does not support the brick work or knit together the materials with which it is used, comes loose from a constant expansion and contraction, disintegrates or falls out, forming crevices or cracks and does not maintain a gas- or air-tight structure.

#### Does it depend on heat for a bond?

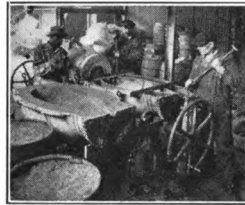
No, HYTEMPITE air sets at normal temperatures, making a wall of uniform strength throughout.

#### Will it stop or prevent air and gas leaks?

Yes, HYTEMPITE will not only stop these leaks, but will withstand the expansion and contraction caused by heat without loosening.

#### What proves its merit?

Over 80% of its sales are repeat orders.



Ramming Lining in Open Flame Melting Furnace

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In the Gas Plant: Patching Cracked Retort with Hytempite

#### What are some of its uses?

1. For laying fire brick and tile.
2. For tightening old walls and arches, sealing openings in new walls, stacks, etc., to make them air-tight, lining doors, etc.
3. Hot patching in furnaces, gas retorts, etc.
4. Making special tile and shapes with crushed old fire brick or carborundum fire sand.
5. Making rammed-in linings with your crushed old fire brick or carborundum fire sand.
6. Bonding new courses or a veneer of fire brick to old walls.
7. Preventing leaks between bricks and iron work.
8. As a wash for surfacing brick work.
9. As a grout diluted or neat, according to requirements.
10. For lining ladles.
11. For patching or building up tuyeres, etc., etc.



## THE CHAS. TAYLOR SONS CO.

Established 1864

GENERAL OFFICES: 706 Burns St., Cincinnati, O.  
MINES: Olive Hill, Kentucky

FACTORIES: Taylor, Kentucky  
Cincinnati, Ohio

Sole Manufacturers of Famous "T A Y C O"—a High Temperature Furnace Brick,  
also Makers of Fire Clay Brick and Shapes

### TAYCO—A New Refractory:

118 TAYCO is *not* an insulating brick, but a special combination of heat-resisting materials, scientifically prepared and combined in brick or special shape form, to successfully meet the maximum temperatures and certain other destructive elements, occurring particularly under high temperatures, in such work as arches and furnace side walls of mechanically stoked boilers, in heating furnaces for forging or welding, the piers and floors of high speed furnaces, electric melting furnaces, etc., etc. TAYCO is the realization of an ambition of long origin to evolve, or create, as it were, an exceptional refractory, a product particularly resistant to high temperatures, and the influences of spalling (popping or flaking off), so common to even the best grades of fire clay brick and other refractory materials, under the modern and more severe operating practices. This deep-seated desire for an exceptional fire brick on the part of The Chas. Taylor Sons Company was lately fulfilled only after many years of constant, untiring laboratory experiments and practical trials.

TAYCO will permit the maximum possibilities of many of the modern and well-designed combinations of boilers and mechanical stokers to be realized.

Silica, Magnesite, Bauxite, Chrome and Carborundum brick are high in refractoriness, but all of them have one or more of such disadvantages as proneness to spalling (breaking, popping or flaking off) under sudden heat changes, inability to withstand much compression under heat, too much expansion, uncertain and uncontrollable shrinkage, suitability for either a basic or acid slag action, and prohibitive cost for general work. Practically all of these refractories are therefore limited in their use.

### TAYCO Softening and Spalling Test:

TAYCO'S fusion or softening point is beyond the temperature limits of testing furnaces in which the same quality of the best grades of fire clay brick has been found. As evidence of resistance to spalling action and physical strength, TAYCO samples were heated on end to 2462 degrees Fahrenheit and plunged in cold water, this operation being repeated twenty times, with a loss of less than

one per cent. Ten per cent under the same severe treatment would still have been attractive.

TAYCO has also outlasted Silica and Bauxite brick in practical electric furnace work where the initial temperatures are about 2000 degrees Centigrade or 3632 degrees Fahrenheit.

TAYCO brick is intended to eliminate or minimize fire brick troubles and to secure continuity and dependability of operation. Ease of mind and plant or fuel efficiency should be considered with cost of laying, in determining additional service required of a higher price brick. It costs just as much to lay a low price product as it does one with a higher selling price.

**Fire Clay Brick:** This Company also manufactures fire clay brick, "*Tiger Steel*," an *extra* first quality made from the famous highly refractory and pure Olive Hill, Kentucky, flint clays, so prominently known for their consistent quality and low impurity content. "*Tiger Steel*" is used for stoker fired boiler furnaces and arch work, blast furnaces, blast stove linings, forging furnaces, steel and glass plant checker room work, oil refinery stills, lime and cement kilns. "*Tiger Steel*" meets the rigid specifications and tests of the U. S. Government.

"*Tiger Crown*," also a Kentucky flint clay brick, is offered for the furnace proper of hand-fired boilers, beyond furnace proper of stoker fired boilers, blast furnace stove and cupola linings, steel and glass plant checker rooms, annealing, core and bake ovens, lime and cement kilns, etc., etc.

This Company owns and operates its own clay mines and weathers for long periods all of its clays.

### Particular Shape Work:

The Chas. Taylor Sons Company are specialists in difficult shapes, this department being divided so that only certain molders make certain general classes of special form material. *Taylor brick molders make brick only. Result:* An exceptional product and a good reputation.

**Boiler Baffle Tile and Door Blox:** Manufacturers of Baffles for all the prominent types of water tube boilers, also Fire Door Arch and Jamb Sets.



# DODGE SALES & ENGINEERING CO.

Distributor of the products of

DODGE MFG. CO., MISHAWAKA, IND.

15 Branch Warehouses in the United States.

Dealers in Every Representative City

## THE EUREKA WATER SOFTENER:

In converting water into steam there is, under the most favorable conditions, a great waste of heat energy. To minimize this loss has been the aim of mechanical men and inventors ever since the adoption of steam as a motive power.

Practically all natural waters are impregnated, to a greater or lesser extent, with soluble metallic salts, which tenaciously attach themselves to the boiler tubes and shell as the water is evaporated into steam, thus forming a cement coating, that not only persistently resists removal, but is also a non-conductor of heat.

Scale  $\frac{1}{8}$  inch thick is very common in boilers and appears to be insignificant, yet careful experiments have demonstrated that even such a thin layer of average composition causes a loss of 9% in heating power, which rapidly increases as the layer thickens between cleanings.

Mechanical cleaners are expensive to operate, both as to power and labor required and the more inaccessible parts of the boiler are *never* reached. In many plants a force of men are continually at work drilling out tubes.

Exhaust steam feed water heaters can remove from water only the carbonates (lime), as these are held in solution by carbonic acid gas which is expelled by ordinary boiling at atmospheric pressure, and the carbonates, being thus released, are partially precipitated in the heater. The sulphates, however, which form the hardest kind of scale, are not affected in the heater, and pass on into the boiler where they are precipitated by the high temperatures attained under pressure.

Another expensive phase of the water supply problem is found in many localities where manufacturers are unable to use their own well water owing to its extreme hardness, and are forced to buy a high-priced city supply, which, though better than their well water, is far from perfect. The cost of treating such waters is comparatively little, the average water running only about two cents per 1000 gallons for the necessary chemicals.

Practically all water supplies, whether from well, stream or lake, can be reduced to a common uniform degree of softness by the Dodge "Eureka" Automatic Water Softener and Purifier.

The water may be supplied to the inlet tank either by pressure or gravity. A constant head is maintained in this tank, and the weight of the water falling on a wheel, E, furnishes all the power required to actuate the plant.

A portion of this raw water is diverted to a saturator, J, where a clean lime solution of constant strength is manufactured. In our method none of the impurities in the lime come in contact with the water to be treated, thus there are no lime particles to go over into the

pipings and boilers. The alkalinity of the purified supply is practically nil, so there is not only no danger of foaming in the boilers, but the water is eminently suitable for all kinds of high-class work, such as in wool scouring, dyeing, bleaching, etc.

A series of spiral plates, N, accelerates the precipitation of the impurities as the water travels upwards after the chemical reaction has



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occurred. The sludge deposited on these plates gravitates into the cone from whence it is flushed to the sewer by simply opening the valve S for a few seconds daily.

After leaving the spiral accelerators the water passes through a wood fibre filter, A, into reservoir Y, from which point it is drawn off for use, all scale-forming matter, mud, etc., having been removed.

The machine starts and stops automatically as water is required and will supply any quantity up to the rated capacity. The only attention necessary is about 20 minutes daily, which can be given by the engineer or other employee without interference with his regular duties. It is never necessary for any purpose whatsoever to enter the machine.

*Further particulars will be furnished upon application.*

## WM. GRAVER TANK WORKS

EAST CHICAGO

INDIANA

**Manufacturers of Steel Plate Work of all Descriptions Including Storage, Truck and Car Tanks, Water Softeners, Water Filters, Cylinders, Stills, Condensers, Agitators, and all other Steel Plate Refinery Equipment**

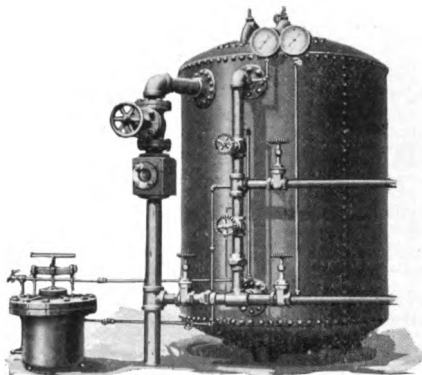
### WATER SOFTENERS:

In scores of industrial plants, Graver Water Softeners are effecting such a large saving through preventing formation of scale that they are more than paying the complete cost of installation and operation in a very short time. Graver Water Softeners are made in types to meet every conceivable water condition, using the lime and soda-ash process, and can be installed either for hot or cold water treating, depending on conditions to be met and use to which the treated water is to be put. By fighting the scale evil at its source by treating feed water itself, and preventing the formation of scale, the efficiency of your boilers is increased, frequent tube renewals no longer are necessary, the lives of your boilers are lengthened, and a tremendous saving in coal is accomplished.

Let our engineers make a free analysis of your water conditions. They will tell you exactly what can be accomplished in your particular case.

### FILTERS:

Water which appears sparklingly clear often contains injurious bacteria. Other waters contain a sufficient amount of suspended matter to make it useless for industrial purposes. Graver filters remove this objectionable matter and render the water suitable for any use. Graver manufactures vertical and horizontal filters of both the gravity and pressure type. Silica sand or crushed quartz is the filtration medium used. One of the advantages of the Graver

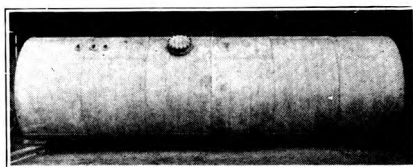


filter is the ease with which it may be cleansed by simply reversing the flow of water through the filter. The Graver water purification department is at your disposal for consultation without obligation.

### TANKS:

Graver steel tanks have been the standard of tank construction for 61 years. We carry in stock tanks of standard sizes upon which shipment can be guaranteed in two weeks. Estimates on tanks of special design and construction and on other steel plate work of all description on request.

Shipping facilities unexcelled. Our location in the heart of Chicago's in-



dustrial district assures our customers prompt shipment and quick delivery. The satisfactory service we have been rendering leading industries for more than half a century is the best evidence of Graver's superiority.

# THE REFINITE COMPANY

REFINITE BLDG., OMAHA, NEB.

## DISTRICT OFFICES

NEW YORK, 9 East 40th St.  
SAN FRANCISCO, 419 Call Bldg.  
MINNEAPOLIS, 703 Plymouth Bldg.  
KANSAS CITY, 611 Grand Ave. Temple  
SALT LAKE CITY, 524 Newhouse Bldg.

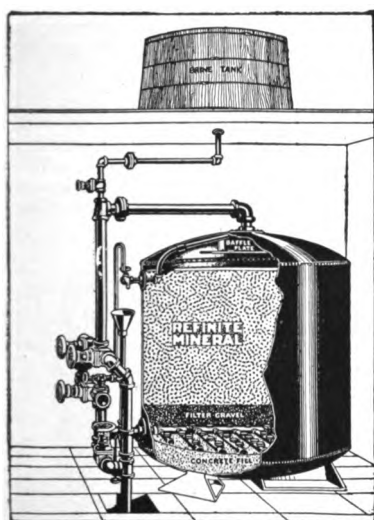
CHICAGO, 1620 Conway Bldg.  
CINCINNATI, 412 Traction Bldg.  
LOS ANGELES, 303 Story Bldg.  
TORONTO, 23 Scott Street  
PUERTO RICO, Thatcher Bldg.

ATLANTA, 320 Hurt Bldg.

Because of advantage given it by Nature **Refinite** mineral permits of greatest simplicity in the construction and operation of the **REFINITE WATER SOFTENER**.

The Softener plant consists of a steel container, brine solution tank, soft water collector, water meter and the proper inlet and outlet openings with their piping and valves. The mineral is supported in the container by a layer of filter gravel resting on the soft water collector.

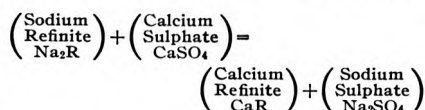
Raw water enters the container through an opening at the top and, striking a



baffle plate, is spread evenly over the mineral. It then passes through the bed of mineral to the collector system, which takes it to an outlet at the bottom of the container. The meter, in the piping outside, measures the amount of water softened.

The softening takes place as the water passes down through the bed of Refinite. Having a strong affinity for calcium and magnesium, Refinite exchanges with these elements, in turn giving up its sodium to the water in proportionate amounts.

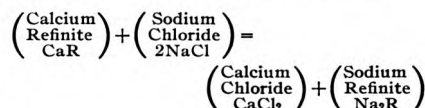
Reaction illustrating softening process:



Overtreating is impossible, as sodium is given up only so long as there are calcium and magnesium in the water to exchange.

After Refinite has softened its capacity, that is, has given up all of its sodium and has become charged with calcium and magnesium, it must be regenerated. This is done by simply shutting off the raw water inlet and admitting a brine solution from the tank placed conveniently.

Reaction illustrating regeneration:



Magnesium salts and  $\text{CaCO}_2$  exchange in same manner.

Refinite, being a natural zeolite, is not sensitive to the presence of small quantities of free carbonic acid gas in water. It is less sensitive for the same reason to the presence of iron, has greater softening capacity pound for pound and weighs more per unit of space occupied.

For these reasons, the container is of the minimum size, the mechanical construction is the simplest and the operating cost is the minimum. Being the simplest, permanent and natural type of water softening equipment which costs little to operate and less to maintain, it commands the attention of the engineer.

For textile mills, laundries, hotels, hospitals, institutions and residences, the performance is unequalled.

Write our district office nearest you for full information.

## WM. B. SCAIFE & SONS CO.

Founded 1802

OAKMONT, PA.

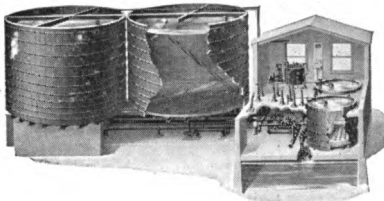
**Water Purification for All Purposes: Continuous and Intermittent Water Softening and Purifying Systems; Pressure and Gravity Filters and Filtration Systems**

### SCAIFE WATER SOFTENING AND PURIFYING SYSTEMS:

The fundamental features of all our designs of systems are—accurate chemical treatment, thorough mixture of reagents with water, accelerated chemical reaction, rapid sedimentation, and perfect clarification. Design for each installation and performance guarantees are based upon scientific investigation of water supply and uses, supplemented by analysis and treatment of water in own laboratory.

**We-Fu-Go System—(Intermittent):** In this system definite quantities of water are treated, therefore accuracy of treatment can be maintained and uniform water obtained regardless of variations in quality of raw water or rate of use. Consists essentially of two or more re-

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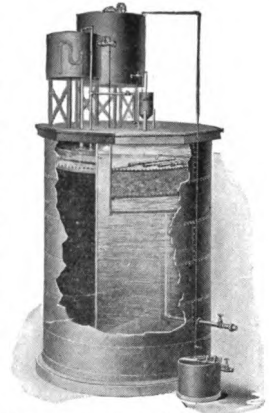
We-Fu-Go System (Patented)

action and settling tanks, which also act as storage tanks, fitted with mechanical stirring devices operated by power, a small reagent mixing tank, means for introducing the reagents into the reaction tanks, and a quartz filter of either gravity or pressure type. Built for any capacity.

**Syphon System—(Continuous):** An automatic system not dependent upon moving mechanical devices for reagent introduction. The water enters a receiving tank to which is connected a syphon, into the long leg of which smaller syphons connect from the solution tanks. Reagents introduced during the period

of syphon discharge. This system can be arranged to be operated either from the ground or from the top.

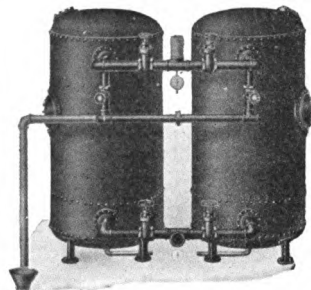
In addition we manufacture three other standard continuous systems and design special systems where required.



Syphon System (Patented)

### PRESSURE AND GRAVITY FILTER SYSTEMS:

**Pressure Filters** are adaptable for every purpose and are built in capacities from 20 gallons per hour upward, to withstand any required pressure. When operated in pairs, each filter is cleaned with filtered water, one filter furnishing the water for cleansing the other.



Pressure Filters

**Gravity Filters** are built in units with capacities varying from 8,000 to 1,000,000 gallons per 24 hours each. Combinations for practically any capacity with required sedimentation can be furnished.

Patented brass conical strainers and patented valveless coagulant feed apparatus are special features embodied in these filters and filter systems.



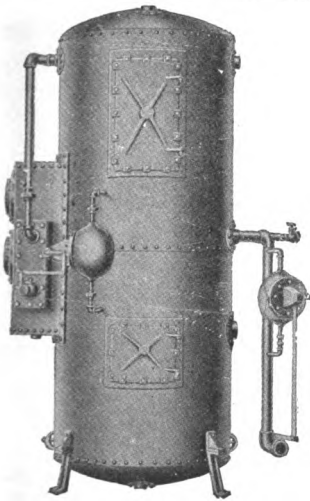
## MILWAUKEE RELIANCE BOILER WORKS

MILWAUKEE, WISC.

Manufacturers of Feed Water Heaters, Gas Producers, Iron and Steel Tanks

### BOILER FEED WATER HEATERS AND PURIFIERS:

Our heaters are built throughout in the most substantial and workmanlike manner. They have an extra large heating surface. They are very accessible for cleaning and parts replacement purposes, etc.



### THE PERFECTION BOILER AND FEED WATER HEATER AND PURIFIER:

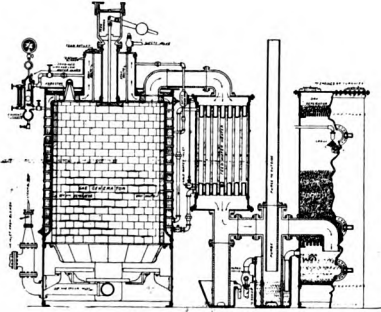
A heater containing all the better features of all other heaters without the faults and failures and incorporating improvements existent in none other. Special positive acting, non-clogging oil extractor. Made in two types, single and double filter, of the underfeed type assuring clean water, as by that method sediment cannot be disturbed by pump suction.

### THE RELIANCE BOILER FEED WATER HEATER:

A Heater and Purifier that is different from the ordinary. Provided with an Oil Extractor that purifies.

### FORSYTH HEATER:

A simple, economical and positive Heater for hot water service in offices and apartments. Heated by exhaust or live steam. Capacity adjustable to requirements.



### SHARP BASSETT IMPROVED GAS PRODUCER:

A Gas Producer that combines simplicity of construction, convenience and ease of operation, economy and reliability under all operating conditions. Made in self-contained units of 25 to 300 H. P. combining in multiple unit plants in any size.

123

Constructed of the best materials and designed by experts. They show upon test the highest efficiency obtainable through any other power-generating apparatus, and this at the lowest cost per unit of power delivered.

### TANKS:

Steel Storage      Air Receivers  
Pneumatic Pressure      Tanks with Coils

### Tanks for:

Packing House      Chemical Works  
Dye Plants      Creameries

We are also equipped to manufacture special plate work of every description.

*Send for Catalogs.*

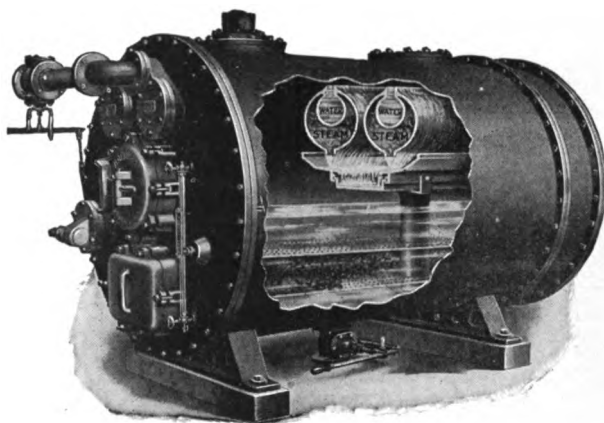
## THE NATIONAL PIPE BENDING CO.

MAIN OFFICE AND WORKS  
NEW HAVEN, CONN.

**Manufacturers of the National Coil or Closed Feed Water Heater. The National Direct Contact Feed Water Heater and Purifier. National Storage Heaters. National Steam and Oil Separators. Coils and Bends of Iron, Brass and Copper Pipe**

BOSTON, MASS., Ruggles & Klingemann, 10 High St.  
PITTSBURGH, PA., H. W. Reisinger, 710 Park Bldg.  
WASHINGTON, D. C., L. C. Holmes, 705 Ouray Bldg.  
PHILADELPHIA, PA., J. S. Hamilton Co., 149 No. 7th St.  
NEW YORK, N. Y., Franklin Williams, Inc., 39 Cortlandt St.  
BUFFALO, N. Y., The H-G-W Corporation, 257 Washington St.  
CLEVELAND, OHIO, Robert R. Harkins Pumping Machinery Co., 2179 East 18th St.  
JACKSONVILLE, FLA., The Cameron & Barkley Co.  
SALT LAKE CITY, UTAH, Hawley-Richardson-Williams Co., 611-612 Dooly Bldg.

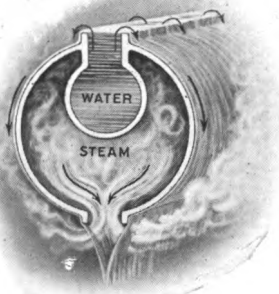
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Patented April 18, 1913

### NATIONAL DIRECT CONTACT FEED WATER HEATER:

The feed water is brought to high temperature by direct and actual contact with the exhaust steam, then freed from those impurities which are precipitated by heating, and, lastly, filtered before flowing to the pump. Combined in one apparatus are a Heater, a Purifier, a Storage Reservoir and an Oil Separator.



The water enters through a regulating valve and is distributed to the smaller or inner pipes which extend the full length of the heater. Overflowing the port at the top, it passes as a thin film over the entire outer surface of the large pipe. During this time it is warmed by the steam in the steam pipe which practically surrounds the water pipe. The exhaust steam after passing through a National oil separator, which forms a part of the heater, escapes from the steam pipe through the port at the bottom and in passing through the curtains of water heats it by actual contact to the temperature of the exhaust steam.

The heated water collects in the tray beneath the pipes and by means of a vertical pipe reaches the bottom of the heater where the scale-forming substances are precipitated. The water then passes upward through the filter material to the hot storage chamber from which the pure hot water flows direct to the pump.

Upward filtration has these advantages: the filtering material needs cleaning or renewal only at long intervals because most of the solids separate out below it, relieving the filter bed of all unnecessary work; in case the perforated plates supporting the filtering material should break, the material will not be carried over to the pump, as would be the case with downward filtration.

A quick-opening blow-off valve at the bottom of the heater affords opportunity to clean the filter bed by reversing the flow.

*Described in Catalog No. 52.*

## THE NATIONAL PIPE BENDING CO.



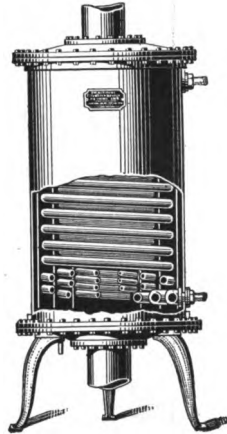
### TYPICAL COIL:

The most difficult pipe bending jobs are executed without flat or wrinkle and in exact accordance with specifications.



### THE NATIONAL OIL SEPARATOR:

This gravity-type oil separator absolutely removes all grease or cylinder oil from exhaust steam so that the condensation may be used for feeding boilers, in laundry or dyehouse service, ice making, or for similar purposes. It has a multi-ported baffle plate, each port having an individual baffle, a distinctive feature found only in the National Separator. The large capacity of this separator not only insures effective separation of oil from exhaust steam but also overcomes the pulsations of exhaust, giving an even flow of steam.



### NATIONAL CLOSED FEED WATER HEATER:

For use when the feed water need not be purified. In the National, the feed water is heated while being pumped through a coil of seamless-drawn copper tubing surrounded by exhaust steam. The water is absolutely free from even a trace of oil, for it does not come in contact with the exhaust steam. The copper has no effect on the water.

125

The enclosing shell is of cast iron or steel plate; it lasts indefinitely because the feed water cannot reach it.

The economy resulting from the utilization of exhaust steam varies from 8 to 13% of the coal burned, depending on conditions—temperature of feed water and boiler pressure; but other advantages are reduction of strains caused by feeding cold water, and increase in boiler capacity.

The National is safe—the coils are tested to 600 pounds water pressure, and the shell is subjected to exhaust pressure only.

More than 3,250,000 horse power of these heaters have been installed.

*Described in Catalog No. 51.*



## **PRATT AND CADY CO., INC.**

HARTFORD, CONN.

**Manufacturers of Feed Water Heaters, Power Pumps, Converters, Hot Water Service Heaters, Distilling Condensers**

**Successor to I. B. Davis & Son, established 1872**

Our Heaters are built with seamless drawn U-shaped brass tubes free to expand and contract without strain. Each end of every U-shaped tube is expanded into the annular grooves in the bore of the tube sheet by cold extrusion. They never leak.

### **THE GENUINE BERRYMAN FEED WATER HEATER AND PURIFIER:**

For boiler feed duty, steam in the tubes, water in the shell. Regular type for pressures up to 100 lbs. Heavy type for pressures over 100 lbs.; horizontal or vertical.

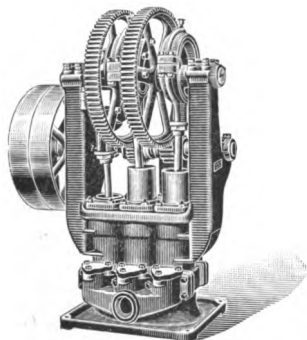
126

Also the water tube type, water in the tubes, steam in the shell.

### **DAVIS DUPLEX, TRIPLEX AND GANG PUMPS:**

Melter Pumps for special sugar house duty.

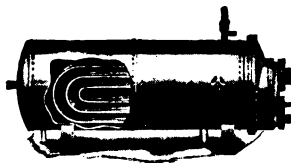
Regular construction for Cold Water. Belt or Electrically Driven. Brass fitted for hot water duty. Guided check or ball valves as required.



Smooth and noiseless in running, maintained efficiency.

### **HOT WATER SERVICE HEATERS:**

Built from regular patterns for any condition of Hot Water Service. For



live or exhaust steam, or both. Built compact for constant and ample steam supply or with storage to suit requirements of intermittent Hot Water Service.

### **DAVIS CONVERTERS:**

For the most satisfactory results when heating buildings with hot water by gravity or forced circulation. The heat units in the steam are transferred to the circulating water while controlled by thermostat set for the desired temperature.

### **DAVIS STILLS AND CONDENSERS:**

For treatment of volatile oils; evaporating by steam and condensing by water. Condensers for Ice Plants.

### **THE GLEANER:**

For fully condensing the steam and transferring all of the latent as well as most of the sensible heat units contained in the condensation to pure clean water; used where the amount of steam is limited or for hot drips from all sources.



## WHEELER CONDENSER AND ENGINEERING CO.

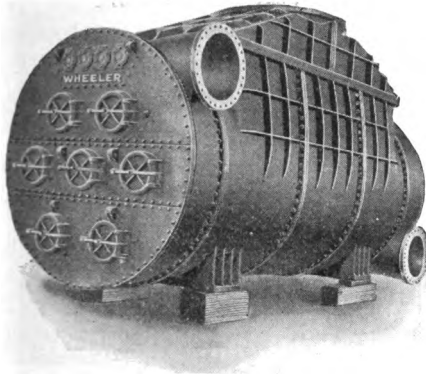
MAIN OFFICE AND WORKS:

CARTERET, NEW JERSEY

Manufacturers of Complete Condensing and Evaporating Equipment  
Including Seamless Drawn Tubes

BRANCHES: NEW YORK, BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS, CINCINNATI, PITTSBURGH, DENVER, SAN FRANCISCO, CHARLOTTE, NEW ORLEANS, ATLANTA, LONDON, YOKOHAMA, MELBOURNE, SHANGHAI, HAVANA

### HIGH VACUUM SURFACE CONDENSERS:



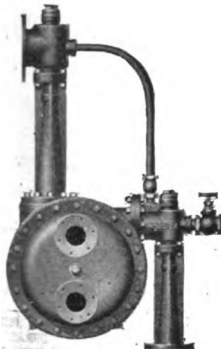
#### Wheeler High Vacuum Surface Condenser

For turbines of any capacity. Tube surface arranged to give best distribution of steam for high efficiency and maximum rate of heat transmission.

### HIGH VACUUM JET CONDENSERS:

For turbines of any size to maintain vacuum of 28 inches and up. Built on the counter-current "rain type" principle.

### WHEELER STEAM JET AIR PUMP:



Wheeler Steam Jet Air Pump, Patented

This patented pump covers the valuable feature of two or more steam jets working in series with a condenser between the jets. Most efficient Steam Jet Air Pump made.

#### WHEELER-EDWARDS AIR PUMPS FOR AIR AND CONDENSATE:

Eliminate expense of independent air and hot well pumps. No suction or bucket valves.

### WHEELER ROTATIVE DRY VACUUM PUMP:

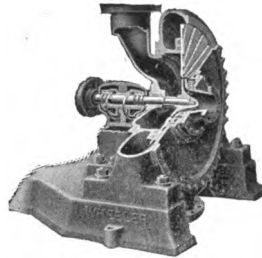
Will maintain a vacuum within 0.5" of barometer. For high vacuum jet condensers and large surface condensing equipments. Clearance effect reduced by an equalizing port.

### WHEELER TURBO AIR PUMPS:

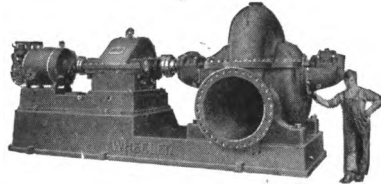
High Speed Rotary Type for jet or surface condensers. Direct connected to turbine or motor.

#### CENTRIFUGAL PUMPS FOR ALL SERVICES:

Circulating tail water and hot well pumps for condensers and high effi.



Wheeler Turbo Air Pump



#### Wheeler Geared Turbine Centrifugal Pump

Efficiency single stage pumps for all purposes. Pumps of all sizes driven by motor, steam turbine or engine for water works, irrigation, etc.

### FORCED DRAFT COOLING TOWERS:

Recommended for efficient cooling of water where ground space is limited. Made in all sizes.

### BRASS AND COPPER DRAWN TUBES:

All standard sizes and gauges manufactured in large Wheeler mill particularly for condensers, evaporators, heaters, reboilers, etc.

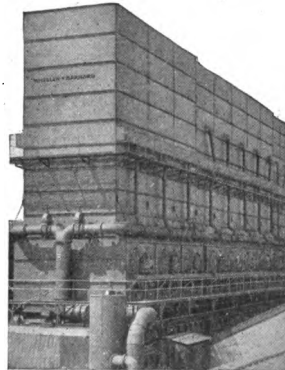
### EVAPORATORS:

Lillie vapor and liquor reversing, or standard types. Multiple or single effect.

### NATURAL DRAFT COOLING TOWERS:

For manufacturing and industrial plants, also central stations where a supply of cooling water is not available.

Put your cooling problems up to our engineers.



Wheeler-Barnard Forced Draft Cooling Tower

# WESTINGHOUSE ELECTRIC & MFG. CO.

EAST PITTSBURGH, PA.

Atlanta, Ga.  
Baltimore, Md.  
Birmingham, Ala.  
Bluefield, W. Va.  
Boston, Mass.  
Buffalo, N. Y.  
Butte, Mont.  
Charleston, W. Va.  
Charlotte, N. C.  
Chattanooga, Tenn.  
Chicago, Ill.  
Cincinnati, Ohio

Cleveland, Ohio  
Columbus, Ohio  
\*Dallas, Tex.  
Dayton, Ohio  
Denver, Colo.  
Des Moines, Ia.  
Detroit, Mich.  
Duluth, Minn.  
\*El Paso, Tex.  
Indianapolis, Ind.  
Joplin, Mo.  
Kansas City, Mo.

Louisville, Ky.  
Los Angeles, Cal.  
Memphis, Tenn.  
Milwaukee, Wis.  
Minneapolis, Minn.  
New Orleans, La.  
New York, N. Y.  
Philadelphia, Pa.  
Pittsburgh, Pa.  
Portland, Ore.  
Rochester, N. Y.  
St. Louis, Mo.

Salt Lake City,  
Utah  
San Francisco,  
Cal.  
Seattle, Wash.  
Syracuse, N. Y.  
Toledo, Ohio  
Washington, D. C.  
Wilkes-Barre, Pa.  
\*W. E. & M. Co.  
of Texas

## ELECTRICAL EQUIPMENT:



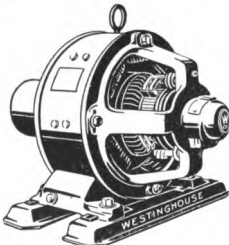
Generating Equipment  
Switchboards  
Switchboard Meters  
Converters  
Heating Devices  
Lightning Arresters  
Motors (Alternating Current)  
Motors (Direct Current)  
Arc Lamps  
Control Equipment  
Transformers  
Regulators

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### Co-operative Service:

Westinghouse Electric & Manufacturing Company, manufacturers of apparatus for Generation, Application and Control of electric power, invite the members of the A. S. M. E. to use the facilities of our engineering department in the planning and selecting of electrical equipment.

Westinghouse Type SK direct-current motors are designed for general constant and adjustable speed service, and, therefore, find extensive application to machines used in practically every industry, especially for driving machine tools and



for other services, where the load is frequently started, stopped, or reversed. The SK motors are of steel construction, with few parts, all of

which are readily accessible. The materials used have been selected so as to combine light weight with great mechanical strength.

Westinghouse Type CS alternating-current motors are designed for general

constant speed service and are, therefore, applicable for driving machines in every industry.



They are made in all standard sizes from 2 to 650 horsepower, for all commercial voltages and frequencies.

Forged open-hearth steel is largely used in the construction, which not only provides great strength but reduces the weight of the inactive material and all overall dimensions, to a minimum. The rotors are practically indestructible; the bearings have very liberal areas, are non-leaking and are protected from dust.

The efficiency, power factor, and overload capacity are unusually high, since high efficiency means low operating costs. Special attention has been given to this point, not only at full loads, but at fractional loads. As a result of these features, type CS motors can be depended on to operate with maximum economy and to give satisfactory service for years, with little attention.



# WESTINGHOUSE ELECTRIC & MFG. CO

## POWER EQUIPMENT:

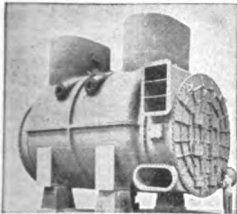


**Turbo-Generators from one to 100,000 Horse Power**

**Condensers—Surface, Low-Level Jet and Barometric**

**Stokers—Underfeed, Roney and Chain Grate**

**Power House Auxiliaries, such as small geared turbo-generators and geared turbines for Pump, Fan and Blower drive**



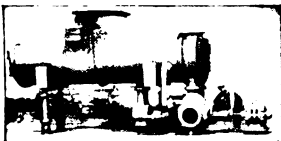
**Large Surface Condensers**

Because of their exceptional performance, Westinghouse Condensers have become generally known throughout this country and abroad as **HIGH-VACUA Condensers**.

They are installed and operating in many parts of the world—Peru, Russia, Brazil, Porto Rico, Manchuria, Cuba, New Foundland, Japan, Hawaii, New Mexico, British West Indies, Alaska, Siberia and other lands. Only Condensers of **UNDISPUTED RELIABILITY** could have become so widely known and used.

At the present time **Westinghouse Surface Condensers** are being built to serve turbines up to 100,000 Horse Power.

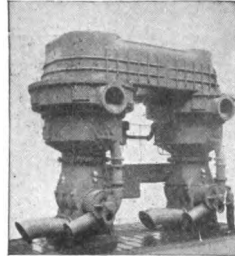
**COMPACTNESS** is a very important feature of all Westinghouse Condensers. This is especially true of the Jet type referred to later, and of the Unit Type



**Unit Type Surface Condenser**

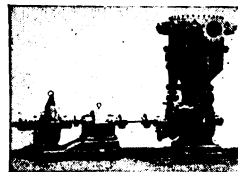
**Surface.** All pumps are located directly beneath and the pump runners all mounted on one shaft, driven by one turbine or motor as demanded by local conditions.

**Jet Condensers** are also built in large sizes—the largest to date being a Twin to serve a 45,000 kw. turbine. The twin type is often made use of when large capacity is required, not because the limit in size of the single condenser is reached, but because the twin type frequently can be better adapted to the requirements of the installation. It has the additional advantage of greater surety of uninterrupted operation, for should it become necessary, the full load of the turbine may be carried on one "leg" with good vacua until the necessary inspection of the other half is completed. This is a feature which should not be overlooked by the prospective condenser purchaser.



**Twin Type Jet Condenser**

**The Westinghouse Leblanc Air Pump, 129** used on all our Condensers, has become well known throughout the country on account of its very high efficiency. Being of the centrifugal type and removing the air by "water pistons" or water layers, it has the peculiar advantage of increasing in efficiency *at the time* highest efficiency



**Small Low Level Jet Condenser**

*is most needed*—as the **VACUUM INCREASES**. Hence the efficiency of the Leblanc Pump rises until maximum air scavenging is attained. The absence of reciprocating parts, valves and clearances, enables it to far exceed the reciprocating pump in efficiency and continuity of service.

Westinghouse Condensers are unexcelled in the ability to maintain high vacua, simplicity of construction, reliability and compactness.

## C. H. WHEELER MANUFACTURING COMPANY

MAIN OFFICE AND WORKS:

SEDGLEY AND LEHIGH AVENUES, PHILADELPHIA, PA.

NEW YORK  
SAN FRANCISCO

BOSTON  
SEATTLE

BRANCH OFFICES:  
CHICAGO  
NEW ORLEANS

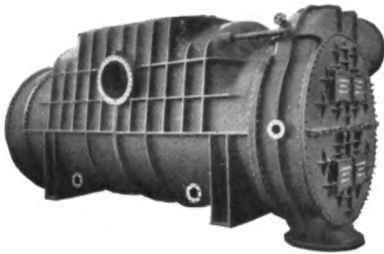
PITTSBURGH  
CHARLOTTE

**Manufacturers of Surface Condensers, Jet Condensers, Vacuum Pumps, Centrifugal Pumps, Direct Acting Pumps, Feed Water Heaters, Engines, Cooling Towers, Fittings, Etc.**

C. H. WHEELER HIGH EFFICIENCY SYSTEM of Steam Condensers and Auxiliaries, in which we specialize, consists of:

### HIGH VACUUM SURFACE CONDENSERS:

With special tube arrangements insuring high heat transmission.



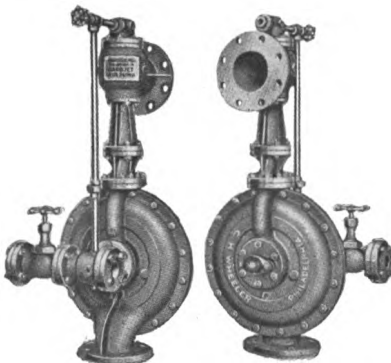
130

### HIGH VACUUM JET CONDENSERS:

Specially designed, insuring complete and intimate mixture of water and exhaust steam.

### VACUUM PUMPS:

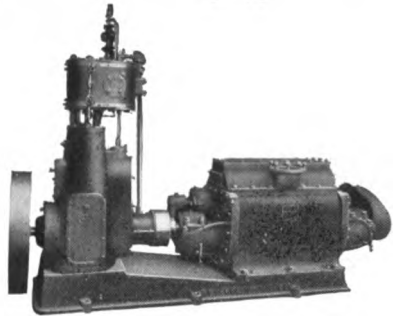
RADOJET, ejector type.



Radojet Vacuum Pump

ROTEX, suction valveless rotary type.

MULLAN, crank and fly wheel type.  
Single Direct Acting Type.



Engine Driven Rotrex Pump

### FEED WATER HEATERS:

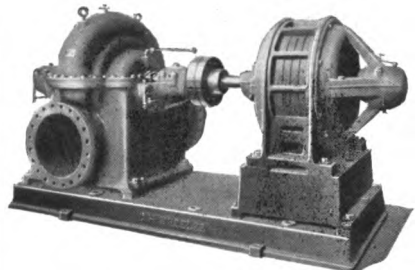
Closed type for primary and auxiliary services.

### WATER COOLING TOWERS:

Forced and natural draft types.

### CENTRIFUGAL PUMPS:

For low and medium pumping heads.



### EXHAUST FITTINGS:

Atmospheric exhaust back outlet Gate Valves.

MULTIFLEX atmospheric exhaust relief valve.

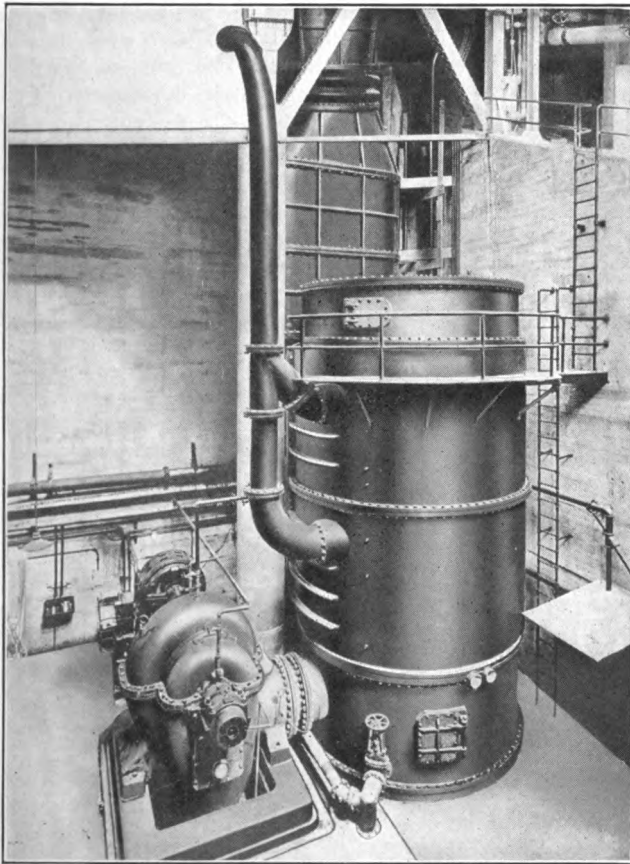
Expansion Joints.

## WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

WORKS: HARRISON, N. J.

**Manufacturers of Surface, Barometric and Centrifugal Jet Condensing Systems, Complete with Auxiliaries; Duplex Direct-Acting, Centrifugal, Turbine and Multi-Stage Pumps for Every Service, Boiler Feed, Elevator, Fire, Pressure Pumps; Water Meters; Water Works, Sewage and Drainage Pumping Engines**



131

30,000 Sq. Ft. Vertical Surface

### WORTHINGTON SURFACE CONDENSERS:

Condenser equipment installed for the Louisville Gas & Electric Co., Louisville,

Ky. This equipment is similar to those installed for the Union Gas & Electric Co., Cincinnati, Ohio.



## CHAIN BELT COMPANY

MILWAUKEE, WISCONSIN

**Manufacturers of Rex Traveling Water Screens, Rex Chain, Rex Sprockets, Rex Concrete Mixers and Pavers, Rex Elevators and Conveyors**

# REX

### TRAVELING WATER SCREENS:

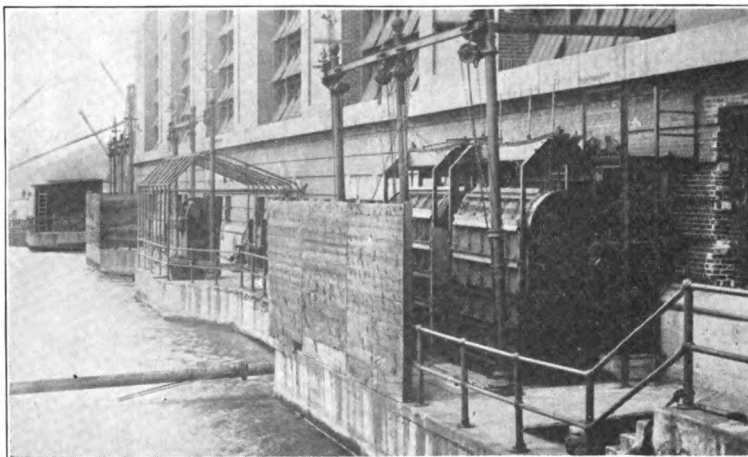
The need for clean water in large volume in Power Plants, Steel Plants, Chemical Plants and many other industries has created a definite demand for some efficient and economical methods of removing debris and sizable particles of foreign matter from the water as it passes through the intake. This need is strongly emphasized by frequent shut-downs which occur when such debris is not properly removed.

132 Rex Traveling Water Screens have been designed to meet this demand for a compact, efficient and automatic self-cleaning water screening device to remove leaves, twigs, fish, lizards, and other injurious debris from the intake water.

The Rex Traveling Water Screen consists of woven wire baskets, carried on two strands of Rex Chabelco steel roller Chain, operating on head and foot

sprocket wheels. It is supported on a steel frame, and is motor driven. The water passing through the screen deposits its floating or suspended refuse either on the screen baskets or in the narrow lifting buckets which extend across the bottom of each basket. This refuse is then elevated from the intake chamber by the travel of the screen baskets, and is automatically removed from them by means of a water spray which washes debris into a refuse trough.

In the construction of the screen, precautions are taken that there are no openings through which debris can pass larger than those represented by the openings of the woven wire cloth of the baskets. The patented front chain guide feature acts as an efficient seal against leakage of debris through necessary clearances, and is an important factor for successful operation. This is accomplished by having the guide extend completely over the chain and the edge of the basket frame, so that even allowing for "floating" or "weaving" of the chain and baskets sidewise when operating, the



## CHAIN BELT COMPANY

MILWAUKEE, WISCONSIN

**Manufacturers of Rex Traveling Water Screens, Rex Chain, Rex Sprockets, Rex Concrete Mixers and Pavers, Rex Elevators and Conveyors**

minimum established clearances are constantly maintained. Without extending the guide over the edge of the basket frame this result cannot be accomplished.

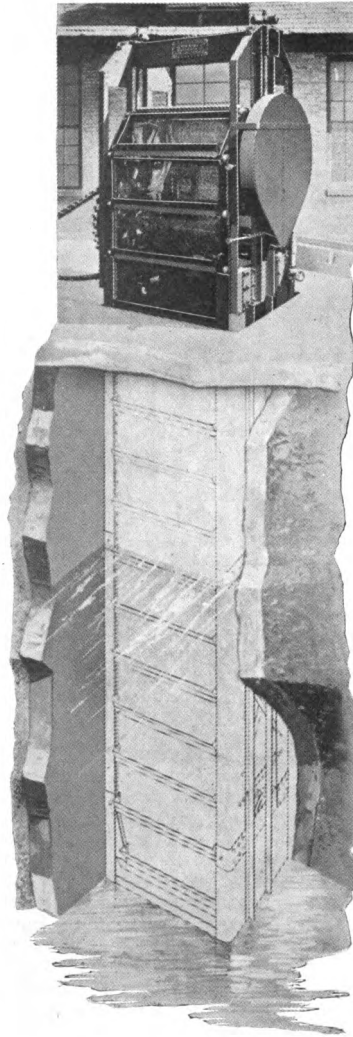
A narrow lifting bucket extends across the bottom of each screen basket to catch and elevate the larger pieces of refuse which do not stick to the woven wire screen cloth.

An overlapping lip is provided on each basket which effectively seals the necessary clearances between baskets.

A steel boot plate at the foot of the screen frame further insures the exclusion of injurious foreign material.

Operating at the slow average speed of 10 feet per minute the wear on Rex Traveling Water Screens is very slight. Screens which have been in operation for five years have required practically no repairs. Except in cases where there is much silt or sand in the water or where there is any acid or salt which would produce chemical corrosion of the metal, the deterioration which takes place is rather the result of the slow rusting action of the water than the wearing out of the working parts.

In the development and perfecting of the design of Rex Traveling Water Screens, Chain Belt Company has collected much valuable data and has developed engineers especially qualified to design screen installations. They can show just what our standardization means in economical intake construction and screen operation. Their services and recommendations are freely at your disposal.



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*Send for Catalog 85 describing Rex Traveling Water Screens. Our engineers will gladly help you solve your intake problems and submit estimates.*

## SPRAY ENGINEERING CO.

93 FEDERAL ST., BOSTON, MASS.

Engineers for Spray Cooling Systems, Air Conditioning, Gas Washing, Aerating Reservoirs, Irrigation Systems

### SPRACO COOLING SYSTEMS:

The SPRACO Cooling System is the simplest, most economical, and efficient device in existence for cooling water used in condensers, water jackets, transformers,



evaporators, and other equipment where the conservation of the water supply is essential.

Under ordinary conditions, the power required averages less than  $1\frac{1}{2}\%$  of the total power generated by the prime movers in the plant. A cooling tower of equal capacity would require for its operation about 3% of the total power generated.

As SPRACO Cooling Systems have a lower initial cost, require less power for operation, and practically no maintenance as compared with well designed and constructed cooling towers, they are being used universally in connection with power plants, sugar centrals, etc.

We find from our experience in designing over six hundred ponds, now in successful operation in the United States and other countries, that it is impossible to lay down exact rules for the design of these ponds, as local conditions make each case a special problem. Hence, if the amount of water to be cooled, the amount of steam condensed in heating this water, the cooling or vacuum desired, as well as the dimensions of the space available for the installation and whether on ground or roof are given us, we will be pleased to send complete specifications and sketch of arrangement best suited to conditions given.

The Spray Engineering Company accepts full responsibility for the design and construction of every SPRACO System (including the pond or concrete basin where desired), and guarantees the cooling obtained in every case.



### SPRACO AIR WASHERS:

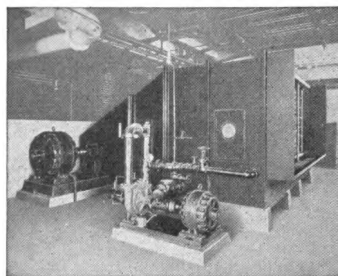
As the capacity of an electric generator is directly dependent upon its temperature, which in turn depends upon the air conditions, an ample supply of cool, clean

air is of great importance.

The cooler the air delivered to a generator, the greater will be its load-carrying capacity. Dust or soot deposited within the machine greatly reduces the efficiency of air as a cooling

medium. Unwashed air, therefore, means excessive heating, which not only reduces the electrical efficiency, but shortens the life of insulation so that grounds and even burnouts are liable to occur.

SPRACO Air Washing and Cooling Equipments are especially designed for conditioning the ventilating air for electrical machines, and give maximum efficiency as regards both cleansing and cooling. Generators equipped with SPRACO washers are free from the above-mentioned troubles. The result-



ing gain in efficiency and capacity, the saving in maintenance, and longer life of the machines to which they are attached, make the installation of SPRACO washers inevitable in all progressive and up-to-date power plants.





## SPRAY ENGINEERING CO.

93 FEDERAL ST., BOSTON, MASS.

**Manufacturers of Air Washing Equipment, Spray Cooling Equipment, Flow Meters, Paint Spraying Equipment, Park Sprinklers, Nozzles for all Purposes**

### SPRACO PNEUMATIC PAINTING EQUIPMENTS:

The modern method of applying paints and other protective coatings is by the use of compressed air. This is rapidly superseding the old hand-brushing method, not only by reason of the great saving



in time and labor, but also due to the fact that better results are obtained. To meet the increasing demand for an efficient, rugged device, suitable for a wide range of work, the Spray Engineering Company developed the improved SPRACO Pneumatic Painting Equipments. They are compact, portable, and well adapted for both field and shop use. Each outfit is complete in itself, ready for attachment by hose connection to your compressed air supply. Where compressed air is not available, we are prepared to furnish gasoline engine or motor-driven air compressor units.

**Some of the Advantages:** One workman can do the work of three to twelve painters using brushes depending upon the nature of the work. Uniformly finished coatings free from streaks and brush marks are produced. Rough, irregular, and inaccessible surfaces are readily coated. Either a lighter or heavier coating can be obtained than is possible with hand-brushes. Standard guns are capable of handling all classes of liquid coatings by using interchangeable caps and nose pieces. The gun and control head may be blown free from paint or cleaned without taking apart. The gun may be mounted on an extension pole for painting surfaces beyond the reach of the operator.

### VAUGHAN FLOW METER:

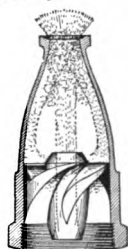
The Vaughan Flow Meter, as illustrated, is an instrument designed to meet the demand for a simple and efficient method of accurately indicating the flow of liquids in pipes under pressure. It is especially applicable for indicating the flow of water to electric transformers, boiler supply, bearing lubrication for turbines, oil for furnaces, as well as miscellaneous commercial purposes where the capacity of the liquid does not exceed 100 G. P. M.



### SPRACO CENTER JET NOZZLES:

The patented SPRACO nozzles are simple in design, yet produce a spray entirely different from that of any other

135



type of nozzle. A part of the liquid is given a rapid rotating motion by the turbine center, and is driven forth through the orifice by the central driving jet, producing a spray of solid conical formation of equal density across its section. This feature makes it the most efficient nozzle on the market, and especially advantageous in cases where it is desired to bring a finely divided liquid into intimate contact with air or other gases. SPRACO nozzles are used for:

- Aerating Water Supplies
- Atomizing Liquids
- Brine Spraying for Refrigeration Purposes
- Evaporating Liquids
- Humidifying Air
- Reclaiming Gasolene
- Scrubbing Gases
- Special Chemical Purposes
- Spraying Bituminous Materials in Road Construction, etc.

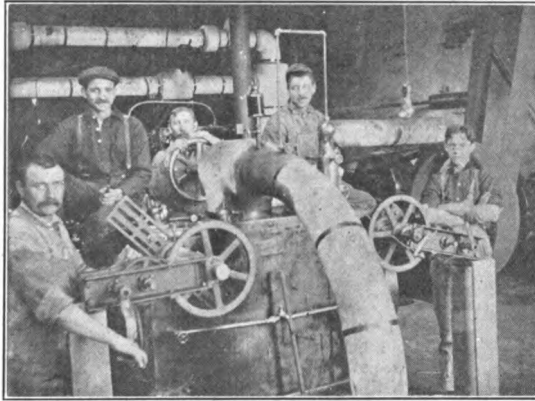
### SERVICE:

Our customers are at liberty to refer their problems to our Engineering Department for advice as to proper installation, operation, etc.

## C. F. WENDLAND ENGINEERING AND CONSTRUCTION CO.

61-63 WOOSTER ST., NEW YORK

New Installations and Emergency Repairs



Boring Valve Ports and Cylinder of 24" x 48" Corliss  
Engine

136

Complete installations for entire power plant—steam and electric.

General repairing to entire steam, electric and refrigerating plants.

Engine and pump cylinders rebored and crank pins turned in position.

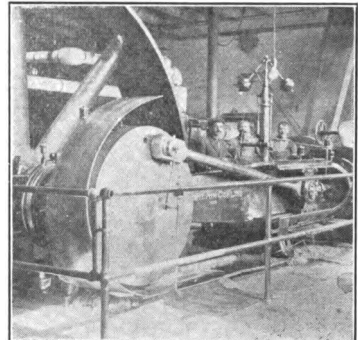
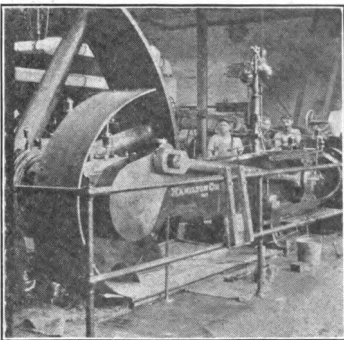
Valves reseated and repaired in position.

Engines indicated and valves adjusted.

Boilers retubed and reset—steam and hot water heating.

Repair shop ready for operation day or night.

Our large force of skilled workmen and accurate portable tools can completely overhaul every boiler, engine, ice machine, pump, compressor, generator, motor or other machinery right in your own plant. All work is positively guaranteed and backed by years of experience in this field.



Altering 24" x 48" Corliss Engine from Bell Crank to Balance Disc Crank

# WHITNEY-MACDONALD COMPANY

Manufacturers and Contractors

TIOGA AND MEMPHIS STREETS, PHILADELPHIA, PA.

**We fabricate pipe for all kinds of piping systems.**

\_\_\_\_\_

**We contract to furnish and erect piping systems in all parts of the world.**

\_\_\_\_\_

**We make pipe bends of all descriptions.**

\_\_\_\_\_

**We make Lap Joints.**

\_\_\_\_\_

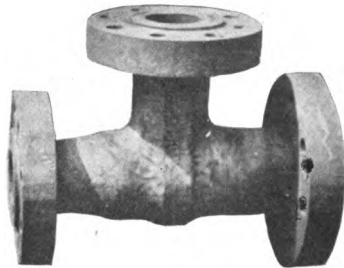
**We make Pipe Coils.**

\_\_\_\_\_

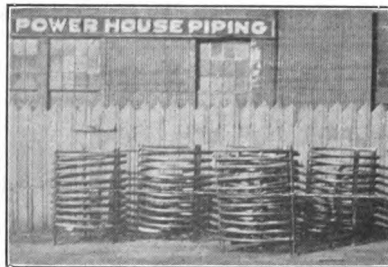
**We do all classes of Oxy-Acetylene Welding.**

\_\_\_\_\_

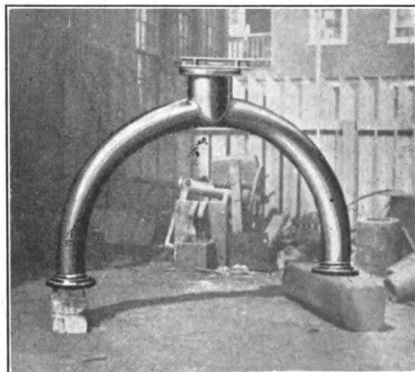
**We make pipe hangers and similar blacksmith forgings.**



6" x 4" x 3" Hydraulic Welded Tee for 3000 lbs. working pressure. All joints and flanges welded.



Pipe Coils.



7" U Bend with 10" welded nozzle.

## CRANE CO.

Founded by R. T. Crane 1855

836 SO. MICHIGAN AVE., CHICAGO, ILL.

Cable address, *Crane*coy, Chicago

Branches in Fifty-three Cities

Cast Steel Valves and Fittings; Cranetilt Steam and Vacuum Traps; Valves, Cocks and Fittings in Brass, Malleable Iron and Cast Iron; Steam Specialties; Complete Piping Equipment; Pipe Bends; Pipe Fitters' Tools; Engineers' Supplies, Etc.

### CRANE CAST STEEL VALVES AND FITTINGS:

We have been manufacturing for some time a line of steel valves and fittings to meet a steadily growing demand for a superior grade of goods, especially adapted for High Pressure, Saturated and Superheated Steam Lines and Extreme Hydraulic Service. These are suitable for steam working pressures up to 400 pounds, and for superheat up to a total



No. 101D Elbow

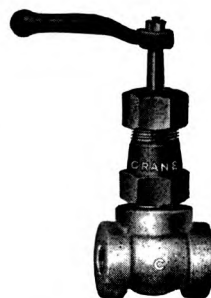


No. 105D Tee

Extra Heavy Cast Steel Flanged Fittings

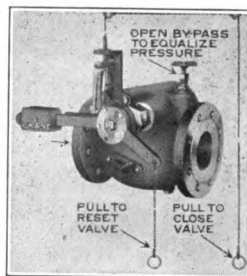
### CRANE FORGED STEEL VALVES AND FITTINGS:

Are suitable for pressures up to 10,000 lbs. depending on the article and size.



### EMERGENCY ENGINE STOP VALVE:

The frequency of accidents which require the shutting off of steam instantly has led several states to require by law a quick-closing Engine Stop Valve on the steam lead to each engine.



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No. 9A  
Rising Stem Gate  
Valve with By-Pass



No. 23A  
Angle Valve

### GENERAL SPECIFICATIONS FOR STEEL VALVES:

CAST STEEL Body, Bonnet, Disc and Yoke  
MONEL METAL Seats

ROLLED MONEL METAL or STEEL  
Stems

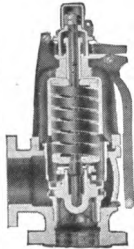
temperature of 800 degrees F. We are prepared to supply Pop Safety, Gate, Blow-Off Valves, and all other material to comply with the A. S. M. E. Boiler Code.

# CRANE CO.

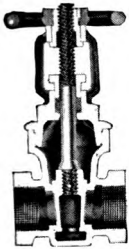
## CRANE VALVES

that comply with the  
A. S. M. E. BOILER CODE:

O. S. & Y. Pop Safety Valves will fulfill all the Safety Valve requirements of stationary and marine boiler rules. Made with brass or monel metal seats. Set to any pressure up to 250 pounds.

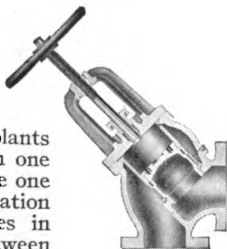


No. 1117 Flanged  
No. 1116 Screwed  
Pop Safety Valve  
Iron or Steel  
2" to 4½"

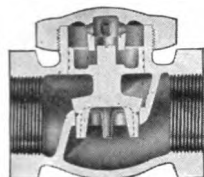


No. 68E Brass  
Water Column  
Gate Valve  
¾" to 2"

O. S. & Y. Extra Heavy Gate Valves for steam working pressure up to 250 pounds and a total temperature of 500° F. Water working pressure up to 350 pounds. Tested to 800 pounds hydraulic pressure per square inch.



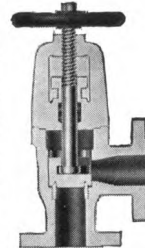
No. 30E Automatic  
Stop Check Valve  
Iron or Steel  
2½" to 10"



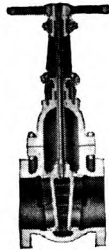
No. 92E Brass  
Boiler Feed Check  
¼" to 3"

Extra Heavy Regrinding Union Bonnet Horizontal Check Valve, made of Crane Special Brass.

We recommend these valves for use as blow-offs on small high pressure boilers and all other purposes where it is desirable to blow off dirty water, or water containing grit or sediment under pressure.



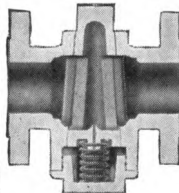
No. 391 Flanged  
Blow-Off Valve  
Iron or Steel  
1½" to 2½"



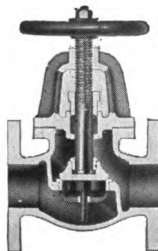
No. 9E  
Gate Valve  
Iron or Steel  
All Sizes

Extra Heavy O. S. & Y. Gate Valves, 6 inch and larger should have a by-pass. We do not recommend the use of screwed valves larger than 6 inch. The outside screw indicates whether the valve is open, partly open or closed.

Extra Heavy All Iron Blow-off Cocks are made with compensating spring, which is located between the plug and the cap and automatically takes up wear and holds the plug securely in place at all times.



No. 317 All Iron  
Blow-Off Cock  
1" to 2½"



No. 87E Brass Boiler  
Feed Stop 1½" to 3"

Extra Heavy Globe and Angle Valves, made with renewable seat and bolted yoke



BOILERS EQUIPPED WITH  
THESE VALVES REPRESENT THE  
BEST ENGINEERING PRACTICE.

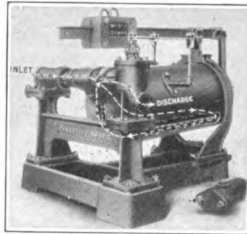
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(Continued from preceding pages)

## CRANE CO. CHICAGO, ILL.

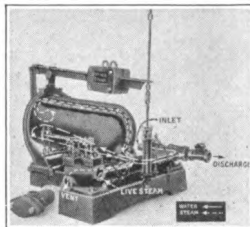
### NON-RETURN TRAP

Made in sizes  
 $\frac{1}{4}$  to 3 inch;  
capacities up to  
50,000 pounds of  
water an hour.



### DIRECT RETURN TRAP

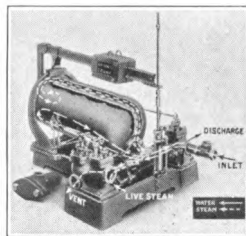
Made in sizes  
 $\frac{1}{2}$  to 4 inch;  
capacities up to  
28,000 pounds of  
water an hour.



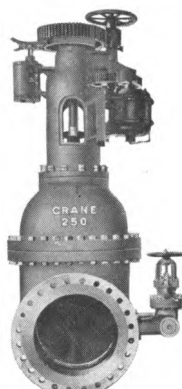
140

### LIFTING AND VACUUM TRAP

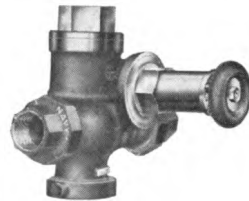
Made in sizes  
 $\frac{1}{2}$  to 4 inch;  
capacities up to  
28,000 pounds of  
water an hour.



CYLINDER  
OPERATED  
VALVE

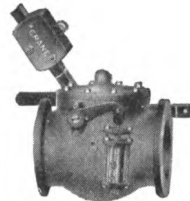


ELECTRICALLY  
OPERATED  
VALVE



### PRESSURE REGULATOR

For steam and air.



### COMBINATION BACK PRESSURE AND EXHAUST RELIEF VALVE

For condensing or non-condensing engines.

### SUMMARY OF CRANE PRODUCTS:

We give on this and the following page a description of our line. We carry in stock at our branch houses a large supply of the goods listed below and are prepared to furnish without delay Special Valves, Fittings, etc., to meet specific requirements or conditions.

The term Standard is applied to products intended for steam working pressures not exceeding 125 pounds. The Low Pressure Fittings, etc., may be used for Steam Working Pressures up to 25 pounds, while the Medium Goods are intended for 175 to 225 pounds. The Extra Heavy are designed for Steam Working Pressures up to 250 pounds.

The proportionate Water-Working Pressure may be taken as follows: Low Pressure, Standard and Medium, 40 per cent greater than the steam pressure on sizes 12 inch and smaller; sizes 14 inch and larger 20 per cent greater.

## CRANE CO.

### LOW PRESSURE GOODS:

**Cast Iron:** GATE Valves; Non-Rising, Rising, Geared, Motor Operated.

FLANGED Fittings; EXPANSION Joints; FOOT Valves.

### STANDARD GOODS:

**Brass:** GATE Valves; Non-Rising and Rising Stems. GLOBE, ANGLE, CROSS and CHECK Valves. COCKS; Steam, Water, Gas and Air. FITTINGS and UNIONS; Screwed and Flanged. RADIATOR and HOSE Valves. EXPANSION Joints.

**Cast Iron:** GATE Valves; Non-Rising, Rising, Geared and Motor Operated. GLOBE, ANGLE, CROSS and CHECK Valves. COCKS; Steam, Water, Gas and Air. FITTINGS; Screwed and Flanged. EXPANSION Joints. DRAINAGE Fittings.

**Malleable Iron:** SCREWED Fittings; RAILING Fittings; UNIONS.

### MEDIUM GOODS:

**Brass:** GATE Valves; Non-Rising and Rising Stems. GLOBE, ANGLE, CROSS and CHECK Valves.

**Ferrosteel:** GATE Valves; Non-Rising, Rising, Geared and Motor Operated. GLOBE, ANGLE and CROSS Valve.

### EXTRA HEAVY GOODS:

**Brass:** GATE Valves; Non-Rising and Rising Stems. GLOBE, ANGLE,

CROSS and CHECK Valves. FITTINGS and UNIONS; Screwed and Flanged.

**Ferrosteel and Cast Steel:** GATE Valves; Non-Rising and Rising, Geared and Motor Operated. GLOBE, ANGLE, CROSS and CHECK Valves. FITTINGS; Screwed and Flanged. BLOW-OFF Valves and COCKS. EXPANSION Joints.

**Malleable Iron:** SCREWED FITTINGS and UNIONS.

### HYDRAULIC GOODS:

**Brass:** GLOBE, ANGLE, CHECK and GATE Valves.

**Ferrosteel and Cast Steel:** GATE Valves, CHECK Valves and FLANGED FITTINGS.

**Forged Steel:** GLOBE, ANGLE and CHECK Valves; SCREWED FITTINGS.

### SPECIALTIES:

COMBINATION BACK PRESSURE and EXHAUST RELIEF VALVES.

AUTOMATIC DOUBLE-ACTING CUT-OUT VALVES.

EMERGENCY ENGINE STOP VALVES.

AUTOMATIC STOP CHECK VALVES.

TEMPERATURE CONTROL VALVES.

IMPROVED POP SAFETY VALVES.

STEAM AND OIL SEPARATORS.

PRESSURE REGULATORS.

CRANETILT TRAPS.

## DARLING VALVE & MFG. CO.

SUCCESSORS TO  
THE DARLING PUMP & MFG. CO., LTD.

WILLIAMSPORT, PA.

Manufacturers of Gate Valves for Water, Steam, Gas, Oil, Acid, Etc., Ball Check Valves, Fire Hydrants, Indicator Posts, Floor Stands and Valve Boxes

**THE DARLING PATENTED GATE VALVE** differs from all others now manufactured in that it has **compound equalizing wedges, Parallel Seats and Double Revolving Gate Discs** thus embodying three distinct advantages, which result in the valves operating easier, wearing longer and giving better service than any other make.

**A, Improved Stuffing Box.** Stuffing Box Bolts are independent of the Gland Bolts which permits the removal of the Stuffing Box without disturbing the Gland or Packing.

142 **B, The Discs** being independent of each other and independent of the Wedges are free to revolve and change their positions on the seats each time the Valve is closed, avoiding unequal wear.

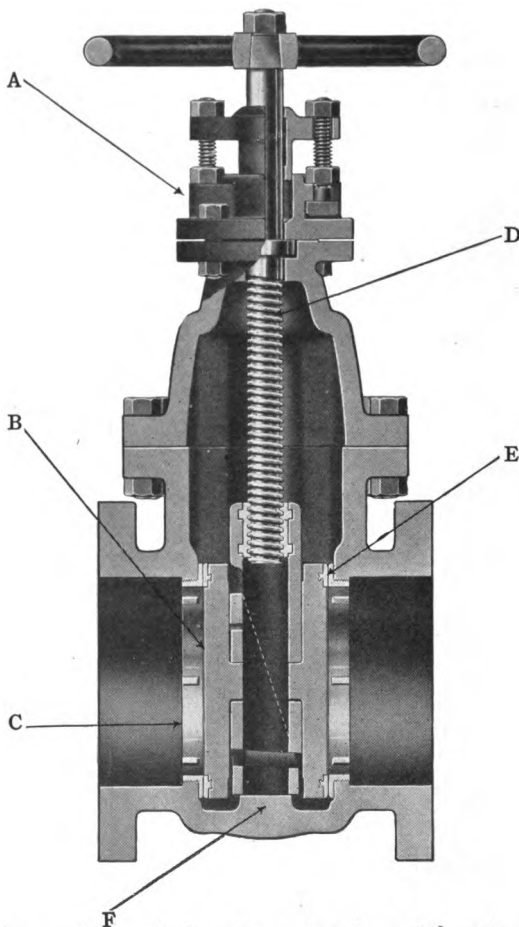
**C, Seats** are renewable. They are made with lugs by which they are screwed into the body and by which they may be removed.

**D, The Stem** works through the threaded hole in the upper Wedge and has a perfectly clear, straight passage down through the Wedges with no irregular shapes to encounter to cause it to bind, bend or break.

**E, The Ground Faces** of the discs and Seats are entirely free from injury and undue wear as the Valve is being closed or opened. In closing the Valve the Discs descend free and clear of the Seats until the Lower Wedge reaches the boss in the bottom of the Case and the Discs then being in front of the Seats, further downward movement of the

Upper Wedge forces the Discs squarely against their Seats. In opening the Valve the first turn of the Stem withdraws the Upper Wedge from contact with the Lower Wedge, instantly releasing both Discs from their Seats before they start to rise.

**F, Boss** in bottom of case that stops downward travel of Lower Wedge.



Valve illustrated is an Iron Body Bronze Mounted, Inside Screw Stationary Stem, Flanged End Gate Valve.



# THE EDWARD VALVE AND MANUFACTURING CO.

72 W. ADAMS ST., CHICAGO, ILL.

BOSTON  
NEW YORK

BRANCHES AT  
PHILADELPHIA

PITTSBURGH  
SAN FRANCISCO

Manufacturers of High Grade Valves and Fittings for High Pressures and Temperatures or Other Severe Service

## CAST STEEL AND SEMI-STEEL STOP VALVES:

For steam pressures up to 350 pounds and 750° total temperature with non-wire-drawing protected seat and disc of monel, insuring long life under severe conditions.

## NON-RETURN VALVES:

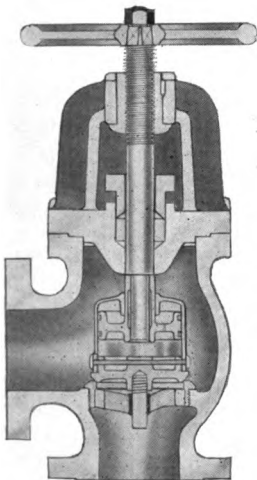
For steam pressures up to 350 pounds and 750° total temperature. All working parts of monel and so designed as to be subjected to the same temperatures, thus permitting closer machining allowances and eliminating possibility of sticking. No springs or weights are used. Dashpot arrangement prevents chattering.

## BRONZE STOP VALVES:

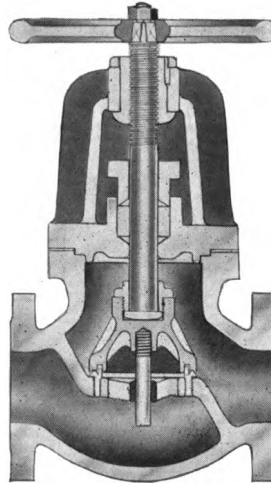
Made of an especially hard bronze composition liberally designed with non-wire-drawing protected seat and disc of monel and suitable for total temperatures up to 500° Fahr.

## BLOW-OFF VALVES:

Made of steel or semi-steel for pressures up to 350 pounds. Seating surface protected from wire drawing by protected seat and disc.



Edward Extra Heavy Angle Non-Return Valve



Edward Extra Heavy Globe Stop Valve

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## DRUMHEAD STOP AND CHECK VALVES:

The requirements of a feed stop and check valve are exceptionally severe, and the Edward valve has been designed with this in view. The body is of steel liberally designed and all working parts are of pure monel. A cylindrical monel check is used in connection with a dashpot to prevent pounding of the disc.

## FORGED STEEL VALVES:

The bodies of these valves are cut from a solid steel forging and our non-wire-drawing protected seat and disc of pure monel inserted. This valve is suitable for steam pressures up to 350 pounds and temperatures up to 750° Fahr.

## CHECK VALVES:

Of steel and semi-steel with all working parts of pure monel. Liberally designed for high pressures and exacting service.

## FITTINGS:

We manufacture all kinds of screwed and flanged fittings for high pressure and superheat, hydraulic and ammonia service.

# THE THOMAS P. FORD COMPANY

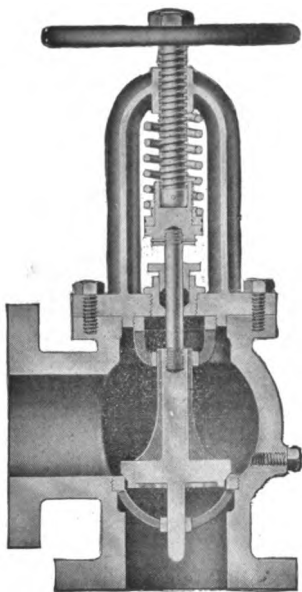
409 BROOME ST., NEW YORK, N. Y.

Manufacturers of The "Ford" Steam and Water Specialties

## THE "FORD" AUTOMATIC RETURN CHECK AND STOP VALVE:

(Pat. 1916)

is a genuine improvement in non-return valves, the construction positively removing the objections encountered in the earlier types, sticking and chattering.



Patented 1916

**Sticking** is caused by unequal expansion in the dash-pot. The "FORD" Valve has no dash-pot.

**Chattering** is caused usually by a dash-pot made of too free and loose a fit, in order to minimize sticking.

The "FORD" Valve employs an entirely different principle, which not only tries to avoid chattering, but which *does* avoid chattering.

As the "FORD" Valve is without dash-pot, we went about the prevention of Chattering from a different angle. Most valves are balanced, causing an equilibrium at a certain opening of piston. The "FORD" Valve is unbalanced and there-

fore does not possess the tendency to chatter. Furthermore, we figured the value of an apron or piston choke-off, "A," so that by the time steam is flowing from boiler into main in any appreciable quantity, the valve disc itself is far enough from its seat to make wire-drawing an impossibility.

It is adjustable for sensitiveness to checking, a feature contained in no other valve.

**Superheated steam:** "FORD" construction produces the ideal valve for superheat work. Contains *not a single snug fit* to stick under extreme temperatures.

**Triple Duty Valves** a trifle more intricate, of course, but a marvel of simplicity for the complex service involved.

*Send for blue prints of*  
**THE VALVES THAT CANNOT STICK**

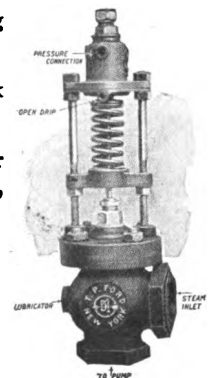
**Pump Regulating Valves**

**High Pressure Tank Float Valves**

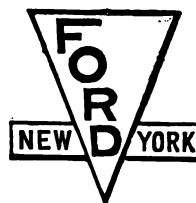
**Steam and Water Reducing Valves, Etc.**

**COMPLETE THE "FORD" LINE**

*Catalog on request*



**Pump Regulating Valve**



TRADE MARK

**Distributors for Middle West**

Dickerson & Bolton,  
1829 Lytton Bldg.,  
Chicago, Ill.

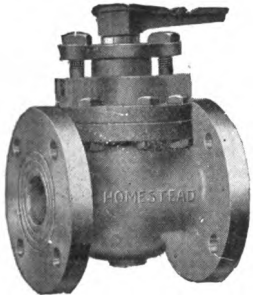
# HOMESTEAD VALVE MFG. CO.

P. O. BOX 1754, PITTSBURGH, PA.

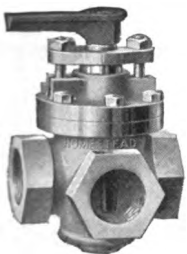
NEW YORK OFFICE: No. 1 Franklin St., NEW YORK CITY

Manufacturers of Homestead Valves and Other Specialties

## HOMESTEAD (Quarter Turn) PLUG VALVES OR COCKS:



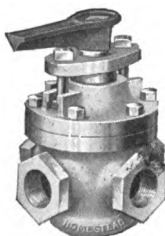
The first illustration shows our Homestead Straightway Valve, with flanged connections. This pattern is used extensively as a boiler blow-off valve.



Homestead Valves are equally serviceable on all kinds of exacting or high pressure work.

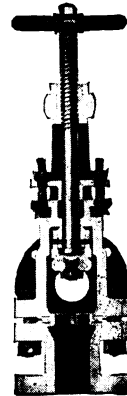
The three-way and four-way valves as shown on the second and third illustrations are used as operating valves on air, water, steam and for many other purposes.

Homestead Valves are so constructed that they open and close with a quarter turn, operate easily and are free from leakage through the valve, the stuffing box or body.



## HOVALCO (Blow-Off) VALVE:

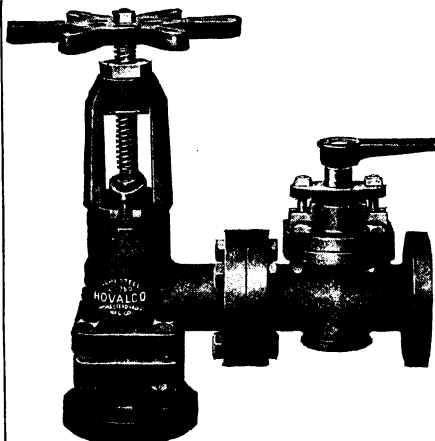
The valve here shown is a new pattern angle blow-off valve, Semi-steel body, and special composition seat. The disc and seat are reversible, renewable and can be reground. Note the accessibility and the ease with which the parts of this valve can be renewed.



Section of Hovalco Valve

Figure below shows the "Homestead" and "Hovalco" valve combined. For boiler blow-off purposes, no better arrangement can be secured. The advantages of the double blow-off arrangement are many, the "Hovalco Valve" can be repaired or renewed at any time without closing down the boiler. This is done by closing the "Homestead Cock," while the repairs are being made. The best power plants being built are specifying this arrangement of blow-off valves.

In accordance with the A. S. M. E. Boiler Code.



"Homestead" and "Hovalco" Valves Combined

Catalogue of our complete line sent upon request.



## JARECKI MANUFACTURING CO.

ERIE, PA.

Manufacturers of Cast Iron, Malleable and Brass Pipe Fittings; Brass and Iron Valves and Cocks, Etc., for Steam, Gas, Water, Air and Oil—Governors—Pipe Threading Tools—Oil Well Supplies



Malleable Fitting



Cast Iron Fitting

**MALLEABLE, CAST IRON AND BRASS PIPE FITTINGS.** Screwed and Flanged. Standard, Extra Heavy and Hydraulic.



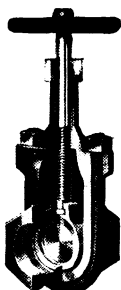
Brass Union, Polished



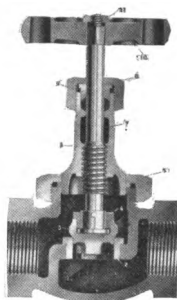
Brass Globe Valve

**MALLEABLE LIP UNIONS, BRASS GROUND JOINT UNIONS,** Standard, Extra Heavy and Hydraulic.

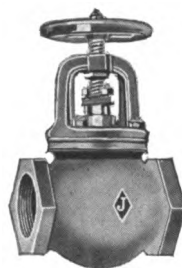
**BRASS AND IRON VALVES AND COCKS,** Standard, Medium, Extra Heavy and Hydraulic, Globe, Angle, Cross, Check, Gate and Regrinding.



"U Clamp" Gate Valve



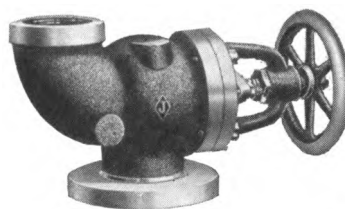
Nickel (or Hard Bronze) Seat and Disc Valve



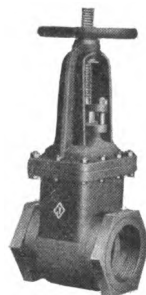
Iron Body Globe Valve

**IRON BODY VALVES,** Plain and Yoke Top, Brass Mounted, Brass and Steel Stem, Screwed and Flanged, Standard, Extra Heavy and Hydraulic.

**IRON AND BRASS FLANGE UNIONS,** Expansion Joints.



Iron Body Engine Valve



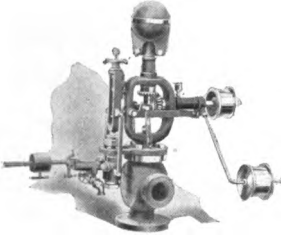
Iron Body Gate Valve

## JARECKI MANUFACTURING CO.

Air  
Compressor  
Governors

—  
Vacuum  
Pump  
Governors

—  
Pump  
Governors

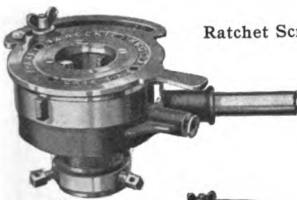


Erie Compressor Governor

**Erie Compressor Un-**  
**loader** maintains prac-  
tically a constant air  
pressure, completely un-  
loads and loads com-  
pressor without shock or  
strain.



Erie  
Unloader  
for All Styles  
of Air  
Compressors



Ratchet Screw Plate



Erie Screw Plate

### ERIE SCREW PLATE AND PIPE CUTTER:

Has adjustable self-centering dies and guides. Each set of dies threads four or more sizes of pipe. Plate can be detached from finished work without turning back on thread.

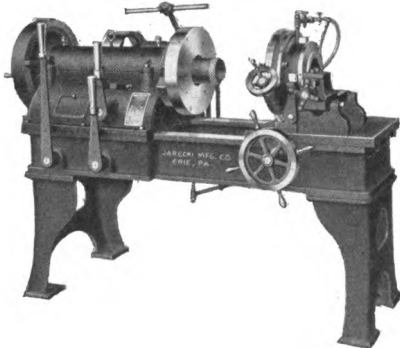
**Ratchet Screw Plate** for threading pipe in corners and ditches.



Pipe Vice

### MALLEABLE PIPE VICE:

By means of the hinged beam which holds upper jaw pipe can be placed in vice at any point; made in four sizes to take pipe from  $\frac{1}{8}$ " to 12".



Pipe Threading Machines

### JARECKI PIPE THREADING MACHINES:

Hand, Belt, Steam Engine or Electric Motor Drive.

There are 21 different styles and sizes of these machines, each threading and cutting eight to twelve different sizes of pipe. The machine shown is our No. 44, which threads and cuts eight different sizes of pipe, from 1" to 4". Each size pipe should be threaded at a certain speed to get the best and most economical results. These eight speeds are instantly obtained by three vertical levers on operator's side of the machine.

# JENKINS BROS.

80 WHITE ST., NEW YORK

133 NO. SEVENTH ST., PHILADELPHIA

524 ATLANTIC AVE., BOSTON

646 WASHINGTON BOULEVARD, CHICAGO

JENKINS BROS., LIMITED

103 St. Remi St., MONTREAL

6 Great Queen St., KINGSWAY, LONDON, W. C.

JENKINS RUBBER CO., ELIZABETH, N. J.

**Manufacturers of Valves in Brass, Iron and Cast Steel; Sheet Packing, Gaskets, Discs, Pump Valves and other Mechanical Rubber Goods**

## JENKINS BRASS VALVES:



**Fig. 106**  
Brass Globe  
Valve  
Standard  
Pattern

Jenkins Brass Globe, Angle and Cross Valves, Standard Pattern, with Jenkins Renewable Discs, suitable for working steam pressures up to 150 pounds, or 250 pounds water. Regularly made in sizes  $\frac{1}{8}$  to 3 inches, screwed or flanged. Larger sizes in brass made from iron body patterns.

Jenkins Hose End Globe and Angle Valves, with Jenkins Discs of flexible rubber composition insuring tightness under cold water pressures up to 250 pounds. Sizes  $\frac{1}{2}$  to 3 inches, with or without cap and chain, in any style of finish required.



**Fig. 114**  
Brass Hose  
Angle Valve

Jenkins Brass Horizontal Angle, and Vertical Check Valves correspond to same standard as the Standard Pattern Globe and Angle Valves. Regularly furnished with Jenkins Discs of semi-hard composition which will soften slightly under the action of hot water. When specified for cold water, air or gas, a soft, flexible rubber disc is supplied, suitable for 150 pounds working pressure. Sizes  $\frac{1}{8}$  to 3 inches, screwed or flanged.



**Fig. 352**  
Brass Swing  
Check Valve

Jenkins Brass Swing Check Valves are made with globe-shaped bodies. Adapted for either horizontal or vertical installation. Furnished with Jenkins Disc, suitable for 150 pounds pressure. Sizes  $\frac{1}{4}$  to 3 inches, screwed or flanged.



**Fig. 124**  
Brass Y Valve  
Standard Pattern

Jenkins Brass "Y" Valves, besides their extensive use for blow-off service, are particularly desirable for handling muddy and gritty water, and thick, heavy fluids. Sizes  $\frac{3}{8}$  to 3 inches, screwed or flanged.



**Fig. 370**  
Brass Gate  
Valve  
Standard  
Pattern

Jenkins Brass Gate Valves, *Standard Pattern*, especially desirable for plumbing or other service under working pressures 125 pounds steam or 175 pounds water. Made both inside screw and outside screw and yoke. Regularly have rough body, finished trimmings; but polished, nickel plated, wood wheel, brass wheel, or other special finish furnished when so ordered. Sizes  $\frac{1}{4}$  to 3 inches, screwed or flanged.

Jenkins Brass Gate Valves, *Medium Pressure*, are especially designed for steam, or hot and cold water lines where high grade installation is required but pressure carried does not warrant use of the more expensive extra heavy pattern. They are guaranteed for 175 pounds steam, 250 pounds water. Sizes  $\frac{1}{4}$  to 3 inches.



**Fig. 270**  
Brass Gate  
Valve  
Medium  
Pressure

## JENKINS IRON BODY VALVES:



**Fig. 142**  
Iron Body Globe  
Valve, Standard  
Pattern

Jenkins Iron Body Valves, *Standard Pattern*, are heavier and considerably stronger than the average iron body valves. Have Jenkins Discs and renewable seat rings. Suitable for working pressures 150 pounds steam or 250 pounds water. Globe and angle valves; sizes 2 to 24 inches inclusive; cross valves up to 8 inches; horizontal, angle and vertical check valves 2 to 8 inches; all iron valves from  $\frac{1}{2}$  inch up; back pressure valves in various patterns and sizes; standard pattern gate valves, with solid double-faced wedges, 2 to 30 inches; medium pressure, 2 to 18 inches, with or without by-pass. Flanges, A. S. M. E. standard dimensions.



**Fig. 325**  
Iron Body  
Gate Valve,  
Standard  
Pattern

# JENKINS BROS.

## JENKINS VALVES FOR HIGH PRESSURE:



**Fig. 128**  
Brass Globe  
Valve, Extra  
Heavy Pattern

Jenkins Extra Heavy Brass Valves, Globe, Angle, Cross, Check and other patterns, are suitable for working steam pressures up to and including 300 pounds, or for water and air pressures up to 500 pounds. Carefully designed, well proportioned, handsomely finished, with the most approved features of construction. Sizes  $\frac{1}{4}$  to 3 inches.

Jenkins Extra Heavy Brass Gate Valves, furnished either inside Screw, Stationary Spindle or Outside Screw and Yoke. Rising Spindle. Sizes  $\frac{1}{2}$  to 3 inches.

Jenkins Extra Heavy Iron Body Valves are suitable for working pressures of 250 pounds steam or 400 pounds water.

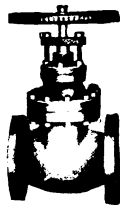
Globe, angle and cross valves made in sizes 2 to 12 inches; valves from 5 inches up can be supplied with by-passes which are cast integral with the body.

Horizontal and angle check valves, 2 to 6 inches; swing check valves, 2 to 8 inches; Y valves, 2 to 3 inches; automatic equalizing stop and check valves, 4 to 8 inches.

Gate valves with inside screw or outside screw and yoke, in sizes  $1\frac{1}{2}$  to 24 inches. Valves can be furnished with by-passes, and their use is particularly recommended on sizes 8 inches and larger. All flanges, A. S. M. E. Extra Heavy Dimensions



**Fig. 164c**  
Iron Body Angle  
Valve with By-  
Pass, Extra  
Heavy Pattern



**Fig. 203**  
Iron Body Gate  
Valve, Inside  
Screw, Extra  
Heavy Pattern



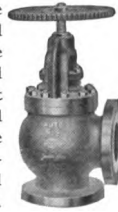
**Fig. 204**  
Iron Body Gate Valve,  
Extra Heavy Pattern  
Outside Screw and  
Yoke



**Fig. 204b**  
Iron Body Gate  
Valve with By-Pass,  
Extra Heavy Pattern

## JENKINS CAST STEEL VALVES

Jenkins Cast Steel Valves are made in globe, angle, gate and check patterns, which experience has shown are perfectly adapted for the severe conditions incident to high pressure superheated steam service. The valves are suitable for working steam pressures up to 350 pounds, and total temperature of 800 degrees F. Furnished in practically the same sizes as the Extra Heavy Iron Body Valves.



**Fig. 293**  
Automatic  
Equalizing  
Stop and  
Check Valve

## MECHANICAL RUBBER GOODS:

In this line we are offering engineering requisites which are the result of over 50 years of progressive effort. We are the original manufacturers of rubber composition discs for valves and unvulcanized sheet packing.

Jenkins '96 is the name of our black high grade unvulcanized or self-vulcanizing packing, furnished in sheets or gaskets, and unsurpassed for all kinds of saturated steam joints. JEN-ARCO is a vulcanized red sheeting. It is very tough and pliable, equally suitable for steam, hot or cold water, and other joints.

Jenkins compressed Asbestos Jointing for Superheated Steam joints.

Jenkins Pump Valves are made from various compounds. There are pump valves of hard composition, particularly adapted for hot water, as with boiler feed pumps; for oils, acids, and other destructive fluids; semi-hard valves for high pressure cold water service as in mines and elevators, medium soft for cold water, very soft and flexible for low pressure cold water and air. When ordering, state the kind of service in which the valves are to be used, the fluid handled, pressure or head pump is working against, and in all cases give diameter, thickness and size of hole.

All genuine Jenkins Valves bear Diamond Trade Mark, and are absolutely guaranteed to be perfect in workmanship and suitable and efficient in the service for which they are designed.



A catalogue of all the  
Jenkins products, giving  
sizes, styles and list prices,  
mailed on request.



## THE KELLY & JONES CO.

GREENSBURG, PA.

Manufacturers of Cast Iron, Malleable, Brass and Steel Fittings; Brass, Iron Body and Steel Valves, Cocks, Etc., for Steam, Gas, Water, Air and Oil

### CAST IRON, MALLEABLE AND BRASS FITTINGS:



Malleable Fitting

We make every conceivable style and size of screwed cast iron, malleable, brass and steel fittings and for all pressures.

All of our screwed fittings are recessed to permit of the easy entrance of the pipe, and threads are cut true to gauge. Will not leak and each fitting a perfect product.

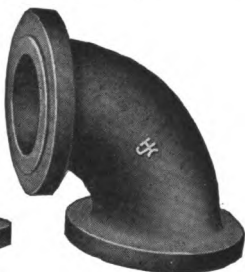
150



Cast Iron Fitting

### FLANGED FITTINGS:

We make a flanged fitting for every pressure and purpose, brass, iron or steel, and in all sizes, straight or reducing.



Flanged Fitting



Reducing Flanged Fitting

Dimensions and drilling in accordance with the latest established standards.

### JENKINS TYPE KELLY & JONES BRASS VALVES:

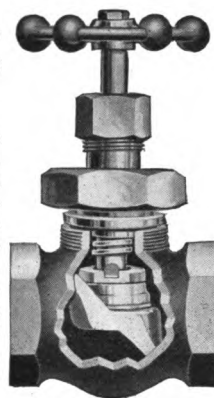
Practical — durable — efficient — economical. Will not leak and can be repacked under full

pressure. These K-J Jenkins type brass valves are made of the highest grade steam metal, carefully machined, and are very attractive in appearance. Special pattern for 100 lbs., standard for 125 lbs.

Furnished in globe, angle, cross and check, screwed or flanged, and in all sizes.

### "EXCELSIOR" HIGH PRESSURE BRASS VALVES:

For high pressure service, 200 or 300 lbs. of live or superheated steam. Used extensively in modern steam plant construction and in the U. S. Navy. Can be furnished with or without yoke, screwed or flanged, globe, angle, cross and check. Sizes from  $\frac{1}{8}$ " to 4".

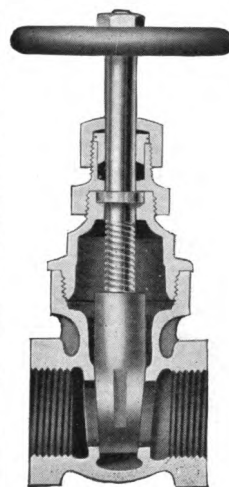


"Excelsior"  
High Pressure Brass Valve

### BRASS GATE VALVES:

The Kelly & Jones line of brass gate valves is most complete. Correctly designed and well proportioned and can be furnished screwed or flanged for the following pressures: 100 lbs., 125, 150, 175, 200, 250 and 1000 lbs. Made with outside screw and yoke if desired for 125 or 250 lbs. pressure.

In addition to the solid wedge type illustrated we make brass gate valves with the double disc, either parallel or taper seats.



Brass Gate Valve



# THE KELLY & JONES CO.

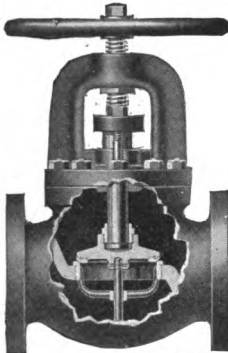
Send for Catalog "R" illustrating and describing our complete line of valves and fittings.

Our **NEW STEEL FOUNDRY** is fully equipped for making in "high quality" steel, any of the valves or fittings shown in our general catalog.

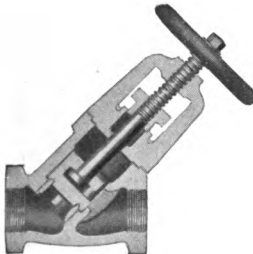
## IRON BODY VALVES:

All styles and sizes for all pressures and purposes including globe, angle, cross, check and safety valves. Screwed or flanged, inside screw or O. S. & Y.

K. & J. blow-off valves, globe or angle, screwed or flanged, perform their function correctly and positively, and thereby prolong the life of the boiler. Built on scientific principles and have been in satisfactory use for years.



Iron Body Globe Valve



Globe Blow-Off Valve

## "SADDLE" GATE VALVES:

All Iron or Iron Body  
Brass Mounted



"Saddle"  
Gate Valve

This saddle style is a very durable and compact valve, and economical, owing to the simplicity of construction. The steel saddle around the body of the valve holds the bonnet securely in place, and can easily be removed, permitting of access to the interior of the valve for cleaning or repair purposes. Opens to the left and has a rising spindle.

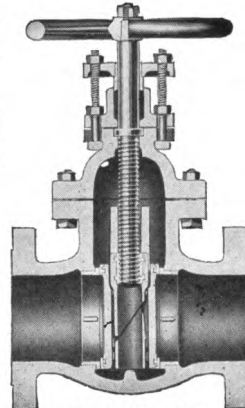
The solid disc in this valve is very narrow and V-shaped at the bottom, and can, therefore, be seated more readily when dirt and sediment are collected between the seats in the valve. Screwed or flanged, sizes  $\frac{1}{2}$ " to 6".

## IRON BODY GATE VALVES:

### Solid Wedge or Double Disc

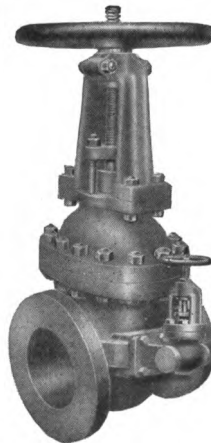
Our iron body gate valves can be furnished screwed or flanged, with or without yoke and by-pass and for 25, 125, 175, 250 and 1000 lbs. pressure.

These valves are also made all iron for temperatures exceeding 325° Fahrenheit and for handling cyanides, acids and other solutions injurious to brass.



Iron Body Gate Valve  
Double Disc

151



Iron Body Gate Valve, Solid Wedge

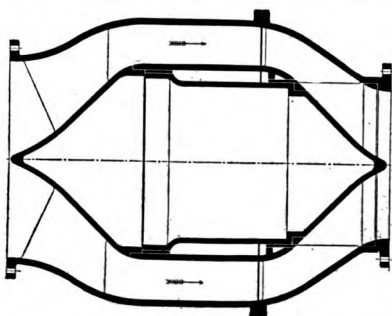
We also make these gate valves with the double disc, parallel or taper seats.

## THE LARNER-JOHNSON VALVE & ENGINEERING COMPANY

WIDENER BLDG.

PHILADELPHIA, PA.

Johnson Hydraulic Valves. Johnson Differential Surge Tanks



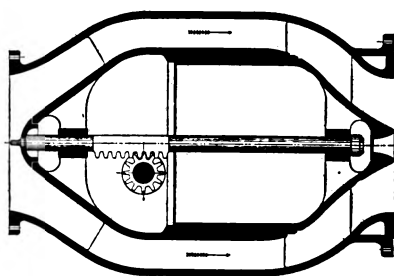
### DIFFERENTIAL PLUNGER VALVE:

Johnson Valves of the differential plunger type are built in all standard sizes up to 18 ft. diameter.

152 They are particularly adapted to remote electrical control although equipped with hand control in addition to electrical control. They require no auxiliary power for operation, do not have to be by-passed and will close automatically in case of a break in the pipe beyond the valve. All parts are circular and therefore not subject to distortion under pressure. The plunger is ground to fit the seat-ring and is absolutely tight when closed. No packing is used on the plunger and there are no delicate internal parts to wear or get out of order. Since the first Johnson valve was built about ten years ago, we have never furnished a repair part of any kind.

Electrical control is accomplished by means of an external control valve equipped with two small solenoids. This valve exhausts pressure from the internal chambers of the Johnson valve and opens or closes the plunger.

**Filtration Plant Valves:** The Johnson Venturi Valve has been designed especially for filtration work. It is a combined valve and Venturi Meter. It is controlled electrically by means of solenoids and may be operated either by exhausting the internal chambers of the valve into a drain or by admitting higher pressure from a service line into the internal chambers. In the latter case there is no external spill. In the former case there is no external spill except while the plunger is in motion. The solenoid circuits are broken except while the plunger is in motion.



### SIMPLE PLUNGER VALVE:

Johnson Valves of the simple plunger type are intended primarily for hand operation. They may, however, be equipped with motors for remote electrical control.

The simple plunger valve has an internal control valve. It is simpler in design than the differential valve and has all of the advantages of the latter except that it cannot be operated by hydraulic means in dead water. If there is no flow in the pipe the valve must be closed mechanically by the control mechanism and this limits its use to sizes from 6" to 30" diameter. Larger sizes are built, however, for motor operation and for cases where there is always flow in the pipe whenever the valve is open.

**Johnson Discharge Regulators:** The Johnson Discharge Regulator is a simple plunger valve of special design for so-called "free discharge" conditions. This Regulator will discharge a jet into the air under any head without danger of vibration or erosion. It is built in all sizes to suit requirements and may be operated either by hand or electricity. It may be set for any position between open and closed and will not drift. It may be arranged by means of float switches to maintain automatically the level of a pond either above or below the Regulator.

The Johnson Discharge Regulator is the ideal device for reservoir outlets in connection with water works, irrigation projects and water power plants.

*Descriptive Bulletin upon request.*

## J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties



### POP SAFETY VALVES:

Were first made under Lynde Patents issued in the year 1872, and have since been improved upon by our corps of capable engineers of long experience who with their combined skill have brought the LONERGAN POP SAFETY VALVE up to its present state of excellence.

#### Points of Superiority:

1. Does perfect work while in service.
2. Repairs practically nothing.
3. Has long life.
4. Always seats perfectly.
5. *Great relieving capacity* as it is the only valve on the market having an expansion chamber above the seat, with baffle plate over that, so as to get the benefit, as the steam lifts the valve off its seat, of both the compressed and *expanded* steam, which construction gives the valve a high lift.
6. *Adjustable screw ring*, very easy to regulate—used to govern number of pounds steam relieved before valve closes.
7. Springs of the best grade PENNSYLVANIA ANALYSIS OPEN HEARTH STEEL, of a fibre stress suited for best results.
8. All valves made with bevel seats, except when otherwise ordered.

#### "Protected Spring" Pop Safety Valve Model "B":

For Water Tube Boilers, etc.

Encased Spring, to protect it from contact with live steam.

LonerGAN Patent Double Eccentric Lifting gear, the best lifting device made.

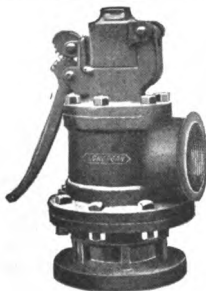
Good for working pressure up to 300 lbs.

Testing yokes furnished at small extra charge.

Fitted for LOCK to prevent their being tampered with.

Recommended for use in Power Stations, Electric Light Plants, Large Manufacturing Plants.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6", Iron Body Bronze Mounted, with either bronze or nickel seats.



Model "B"

#### "Marine" Pop Safety Valve Model "D":

For use on Marine Boilers.

General Specifications same as Model "B."

Handle on top allows valve to be turned on its seat when under steam pressure.

Repairs easily made as valve can be broken below outlet, for seat repairs.

Complies with rules of:

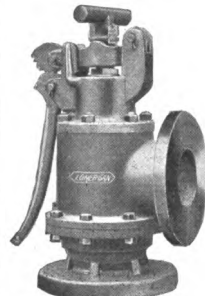
United States Board of Supervising Inspectors of Steam Vessels.

Board of Trade, Great Britain.

British Lloyds.

Bureau of Veritas, France.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6". Iron Body Bronze Mounted.



Model "D"

### DUPLEX POP SAFETY VALVE (MODEL "F"):

Two valves in one base casting. Furnished with outlet at either end, or in center. Made in Bronze, Steel, Semi-Steel and Iron. Equipped with Rocker-shaft Lifting Gear so valves can be lifted in succession or simultaneously. Used largely by U. S. Government, Merchant Marine, etc.

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### WATER RELIEF VALVES:

Good for working pressures up to 300 lbs. Recommended for use on Pumps, Hydraulic Elevators, Pipe Lines, Water Works, etc. Relieving capacity unequalled by any other make of valve on the market.

### CHIME WHISTLES:

Made in two types, MODEL "WV," Adjustable Lever with valve. MODEL "WN," without valve. Bell diameter sizes from 1½" to 12". Bells of solid cast bronze and not built up with a web inside of a lap-welded tube. Recommended for Marine and Stationary Work, Fire Alarms, etc.

We also manufacture Cylinder Relief Valves, Plain Whistles, Quick Closing Water Gauges, Automatic Closing Water Gauges, Chain Pull Gauge Cocks, Oil Cups, Grease Cups, Jelco G. G. Cutters.

# NELSON VALVE CO.

CHESTNUT HILL, PHILADELPHIA, PA.

NEW YORK  
WASHINGTON

PHILADELPHIA  
CLEVELAND

## SALES OFFICES

CHICAGO  
SYRACUSE  
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**Manufacturers of Valves in Bronze, Iron and Steel. Gate, Globe, Check, Non-Return, Back-Pressure and Motor-Operated Valves**

Nelson Valves are primarily a line of valves adapted to the requirements of high class power plant installations. They include all the principal types usually employed in high-pressure superheated steam lines, high pressure saturated steam lines, low pressure steam, water, air and exhaust lines. These types are supplemented by special lines for general industrial service, including valves for acids, alkalis, oils, etc.

154



**Fig. 1552**  
Steel Gate Valve

The success of Nelson Valves in this field during 20 years of service has established them in the confidence and favor of engineers and valve users generally. The company's aim is to make every Nelson Valve a *good* valve and for the user a *safe* valve investment.

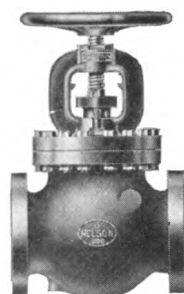
## STEEL VALVES:

Nelson Steel Gate Valves represent the highest standards in steel valve construction. The No. 1552 line is fully monel mounted, with high bonnet and condensing chamber, Nelson flexible double-disc gate and taper seat, cork grip hand-wheel and other important engineering features. These valves are recommended for steam working pressures up to 350 lbs. and temperatures up to 800 degrees. Other types of steel gate

valves are made for low superheat, feed water, etc.

## Nelson Steel Globe

Valves are designed to meet the best engineering specifications and to provide great strength and reliability. Cast yoke and marine yoke types are made with monel mountings for high pressure and high superheat. Other types are provided for low superheat. All bonnets have through bolts.



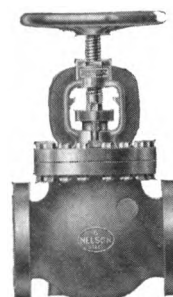
**Fig. 1300**  
Steel Globe Valve

Nelson Steel Non-Return Valves are extremely simple, providing effective and dependable protection for batteries of boilers. The number of parts is minimized, leaving nothing to work loose or get out of adjustment. They are heavily built and either mounted fully in monel metal for high superheat, or special bronzes for low superheat.

## Special Metal Valves

for Superheat in small sizes for drips and auxiliary lines are provided to supplement

the above principal steel valves.



**Fig. 1370**  
Steel Non-Return Valve



# NELSON VALVE CO.

## IRON VALVES:

For High Pressure Saturated Steam, water and other fluid lines, there is a complete range of Nelson types and sizes including:



Fig. 530  
Extra Heavy Iron  
Gate Valve

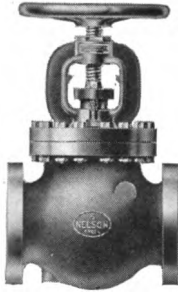


Fig. 620  
Extra Heavy Iron  
Globe Valve

Gate Valves, with the Nelson flexible double-disc, taper-seat construction, in stationary stem and rising stem patterns, with and without by-pass.

Globe Valves, sturdily built of heavy parts, with through-bolted bonnets and features of design insuring accurate, permanent alignment of parts and long, satisfactory service.

Non-Return Valves of the same simple design as the steel non-return valve heavily built and thoroughly dependable as a protection on batteries of boilers.

Swing Check Valves supplementing the above lines in every detail of service qualities.

For Medium Pressures there are inside and outside screw gate valves, globe and angle valves, bronze mounted, built especially to meet the needs of this class of service.

In standard 125 lbs. working pressure and light pressure valves, there is a valve

for nearly every purpose, including gates, regrinding and composition disc globes, checks and back-pressure valves.

## BRONZE VALVES:

Nelson bronze valves are made of exceptionally high quality metal mixtures, under a thorough system of manufacture, inspection and test. Castings are clean, sound and of good color, and all working parts, threads and hexes of valves are of liberal proportions, providing a good reserve of strength above regular working requirements.

Gate Valves include standard, medium and extra heavy types of Nelson double-disc, taper-seat design, and extra heavy outside screw and yoke gate valves.

Globe Valves include standard regrinding valves, heavy union bonnet valves and heavy composition disc valves.

Check Valves include swing checks, horizontal checks and vertical checks.

155



Fig. 85  
Standard Bronze  
Swing Check Valve



Fig. 101  
Standard Bronze  
Gate Valve

*The new catalog of Nelson Valves, showing the complete line, with specifications and prices will be sent on request.*

*Valves, Fittings, Piping*

## PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

P. O. BOX 1016, PITTSBURGH, PA.

**Engineers, Founders, Pipe-Fitters and Machinists**

**Sole Manufacturers of Gulland Automatic Stand Pipes**

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DENVER, COLO., Mountain States Mach. Co.

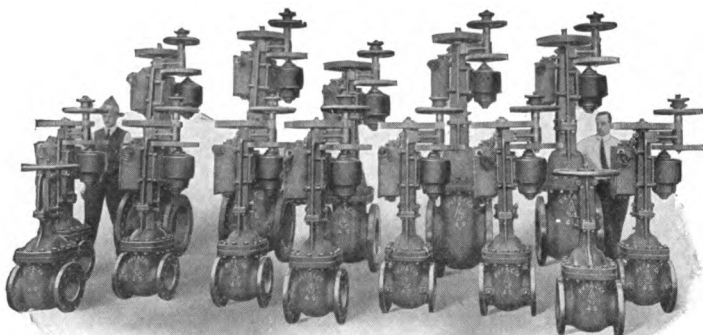
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SAN FRANCISCO, CAL., E. A. Keithley, Rialto  
Bldg.

**VALVES, FITTINGS AND APPLIANCES**  
of every description for Steam, Gas,  
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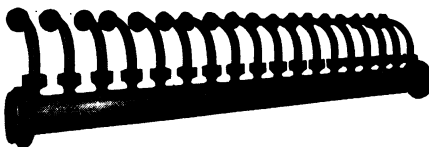
Group of Motor-Operated Gate Valves

**SPECIAL VALVES AND FITTINGS:**  
for hydraulic installations. Motor Oper-  
ated and Cylinder Operated Gate Valves.  
**Hydraulic Operating Valves** for blast  
furnace doors and bells, and for steel  
mill tables and rolls.

### COMPLETE PIPING CONTRACTS EXECUTED:

We are prepared to install valves,  
fittings or piping anywhere and under  
any conditions. A large corps of expert  
fitters is constantly employed, and this  
branch of work is in charge of competent  
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Special facilities for casting and ma-  
chining large pipe fittings, furnace cast-  
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16" Welded Header with 18-4" Branches

### PIPE CUTTING, BENDING AND WELDING:

Branches and manifold out-  
lets fabricated by our patented  
Interlock Method.



# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

## STANDARD LINES OF GATE VALVES:

### Specifications for material

Grey Iron—22,000 lb. per sq. in. tensile strength.

Semi Steel—33,000 lb. per sq. in. tensile strength.

Parallel seat, 50 lb. working pressure. 75 lb. test pressure

Sizes 14" to 72" cast iron. Low pressure. For water, gas, air or exhaust steam. Extremely close face to face, invaluable in complicated piping connections.



Parallel seat, 125 lb. working pressure. 300 lb. test pressure

Sizes 2" to 48" cast iron. Standard pressure. For water, air, steam or gas. Fully bronze mounted. Especially adapted to water distribution.

50 lb. Parallel Seat Gate Valve. Close Pattern

Parallel seat, 200 lb. working pressure. 400 lb. test pressure

Sizes 1½" to 16" cast iron. Largely used for natural gas under the lower pressures. Furnished either all iron or iron body bronze mounted.

Parallel seat, 400 lb. working pressure. 800 lb. test pressure

Sizes 3" to 20" semi steel. In extensive use for the transmission of natural gas. Furnished either with or without bronze mountings.

Parallel seat, 500 lb. working pressure. 1500 lb. test pressure



4" 1000 lb. Gas Line Gate Valve

Sizes 2" to 12." For water or oil at pressure noted. Semi steel with solid bronze mountings.

Parallel seat, 1000 lb. working pressure. 1500 lb. test pressure

Sizes 2" to 12" semi steel. High pressure gas valve used chiefly at the gas wells and on feeders in the gas fields.

Parallel seat, 1500 lb. working pressure. 2000 lb. test pressure

Sizes 2" to 10" semi steel. For hydraulic service and extreme natural gas rock pressures.

Taper seat, 175 lb. working pressure. 500 lb. test pressure

Sizes 2" to 16" semi steel. A valve for medium steam pressures from 125 lb. to 175 lb. where a less expensive valve than the 250 lb. type is desired.

Taper seat, 250 lb. working pressure. 800 lb. test pressure

Sizes 1½" to 28" of semi steel with solid bronze mountings for ordinary steam pressures. Sizes 2" to 24" for superheat steam up to a temperature of 500 degrees Fahrenheit of cast steel with full monel mountings, monel stems and cooling chamber to protect packing.

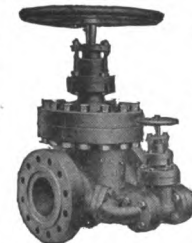


14" Cast-Steel Gate Valve for Superheat Steam

157

Taper seat, 1000 lb. working pressure. 2000 lb. test pressure

Sizes 1½" to 12". The strongest valve possible to make in its weight, all surfaces being cylindrical or spherical segments.



Gate valves for any pressure

Designs and quotations furnished for valves for special conditions or higher pressures. Materials used are those best adapted to service.

8" 1000 lb. Hydraulic Gate Valve

## PRATT AND CADY CO., INC.

HARTFORD, CONN.

Manufacturers of Valves and Asbestos Packed Cocks

### RENEWABLE SEAT GATE VALVES:

#### Bronze and Iron

All styles for all pressures. Sizes up to 24 inches.

With renewable seat rings, held in place by separate retaining rings easily removable.

The seat rings are independent rings of bronze, or any special metal or material best adapted for the service in which the valve is to be used. The gate is a double-faced wedge-shaped casting,

with side grooves by means of which it slides on guides in the valve body.

Gauges are used in machining all parts to insure their accuracy and interchangeability.

The guides in the bodies are of equal thickness, and the wedge can be taken out of the valve and replaced with the opposite faces in

contact and will give an accurate fit. The importance of this in making repairs is obvious. These valves being double seated, can be used with the pressure applied at either end.

### REGRINDING SWING CHECK VALVES:

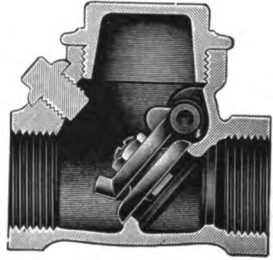
#### Bronze and Iron

All styles for all pressures, sizes up to 36 inches.

The design combines pressure resistance with easy flow lines. Material (of bronze valves) is 86% pure copper. Each valve is tested to an adequate pressure. All seats are carefully ground. Assembling

is done by expert mechanics. The interior construction permits the replacement of any working part without removing

valve from line. For regrinding no tool is necessary but a wrench, brace and bit.



Regrinding Swing Check Valve

### ASBESTOS-PACKED COCKS:

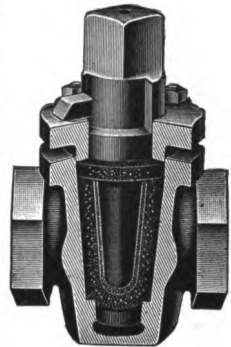
#### Bronze and Iron

Made in sizes  $\frac{1}{8}$  inch to 8 inches, for all pressures.

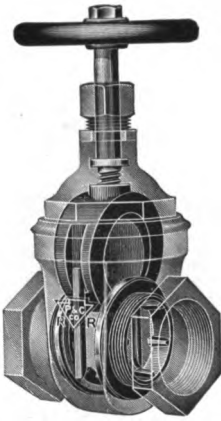
The dovetailed, U-shaped grooves in the body are packed with prepared asbestos. An asbestos ring is used on the shoulder of the plug for top packing.

The plug is of standard taper carefully finished and barfed to render it rustless. It has no metallic bearing, coming in contact only with asbestos, the elasticity of which compensates for the differential expansion and contraction of the plug and body. The gland admits of adjustment by means of its bolts.

These cocks give exceedingly satisfactory results as boiler blow-offs and water column blow-offs, between check and boiler, between water column and boiler, and they do work where ground plug cocks, globe, angle or gate valves fail.



Asbestos-Packed Cock



Renewable Seat Gate Valve



# PRATT AND CADY CO., INC.

## BRONZE GLOBE AND ANGLE VALVES:



Bronze Globe Valve

Made in sizes  $\frac{1}{8}$  inch to 3 inches for pressures to 250 pounds.

The stuffing box gland is long, heavy and well fitted.

The spindle collar, and its point of contact with the bonnet, have specially smooth surfaces and make a steam-tight joint

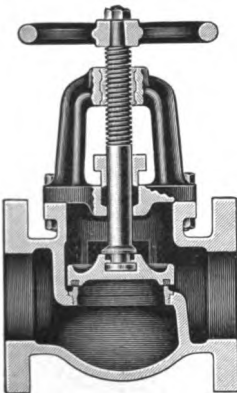
when valve is fully open.

The disc holder is guided by four splines in the body, assuring perfect alignment at all times. The disc holder is of the horseshoe type, and can be removed and replaced, the only tool necessary therefor being a wrench to unscrew the bonnet.

The seat is rounded, thus preventing the settling thereon of any substance that might hold the disc from going squarely to its place. The bronze in these valves is approximately 86% pure copper.

## IRON BODY GLOBE AND ANGLE VALVES:

Made in sizes 2 to 8 inches inclusive for pressures up to 250 lbs.



Iron Body Globe Valve

The discs in these valves are of the horseshoe type with an asbestos ring for pressures up to 150 lbs., and a copper ring for pressures up to 250 lbs. The disc holder is guided by four splines cast in the body which insures perfect

alignment and prevents chattering. These valves can also be provided with

a steel spindle and an all-iron disc, if so ordered. The seat rings as well as the discs are easily removable and renewable and this work may be done without removing the body from the line. We use the utmost care in machining and assembling these valves and can thoroughly recommend them in places where other types of globe valves have not given satisfaction.

## CAST STEEL GATE VALVES: (For Superheated Steam)

All tested to a hydrostatic pressure of 800 lbs., suitable for 250 lbs. pressure and 200 degrees superheat.

All valves  $2\frac{1}{2}$ " to 6" are equipped with cast steel bodies, bonnets, yokes and nickel-bronze wedges.

Valves 7 inches to 16 inches have cast steel wedges.

The seats and faces of the wedges are made of nickel-bronze, securely fastened in place so that they cannot work loose.

Stems are cold rolled steel.

All bolt holes are spot faced.

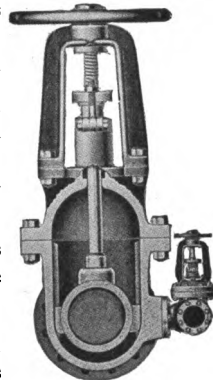
Bonnet joint is packed with the best grade of super-heat packing.

The end flanges have  $\frac{1}{8}$ " raised faces, extending full width inside of bolt holes, with smooth finish.

All bolts have hexagon heads and nuts, with their under sides semi-finished.

The discs can be furnished either split or solid wedge pattern.

Stuffing box is made with hinge bolts, very deep for square packing.



Cast Steel Gate Valve

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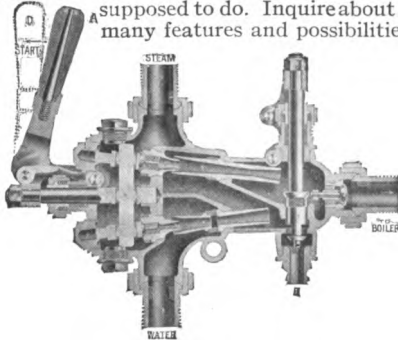


## SCHUTTE & KOERTING CO.

1184 THOMPSON ST., PHILA., PA.

BRANCHES: NEW YORK, BOSTON, CHICAGO, PITTSBURGH, CLEVELAND,  
DENVER, KANSAS CITY, CHARLOTTE, NEW ORLEANS

The Koerting Universal Double Tube Injector requires only one lever to operate, needs no adjustment, takes water up to 150° F., discharges into boiler near boiling point. Will do everything an Injector is supposed to do. Inquire about its many features and possibilities.

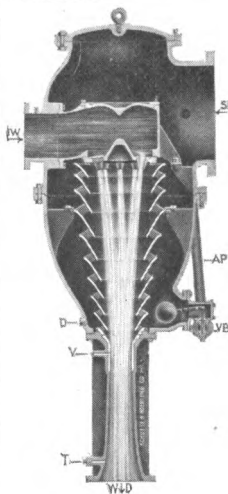


Koerting Universal Injector  
Over One Million in Use

160 Our Condenser and Jet Department handles apparatus for:  
Lifting and Heating Liquids  
Moving Air, & Gases also Injectors  
Syphons Spray Nozzles  
Strainers Suction Draft Systems  
Exhausters Blowers

### COMPLETE CONDENSING AND COOLING EQUIPMENT:

The Koerting Multi-Jet Condenser is of the low-level type built in all sizes up to 5000 KW. in single units, for larger units a twin arrangement is provided. Maintains a high vacuum without the use of an air pump, the jets serving to condense the steam and remove the air. No moving parts or stuffing boxes in vacuum chamber. Low head room.



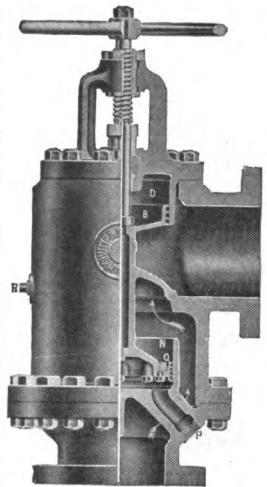
Multi-Jet Condenser

### SCHUTTE VALVES:

Stop Check (Non-Return)  
Emergency Stop Check  
Engine Stop Systems  
Trip Throttle—Balanced  
Free Exhaust Back Pressure  
Butterfly Gate  
Hydraulic Reducing  
Pump Governors Butterfly  
Lead Valves

The Schutte Emergency Valve shown is of the Triple Duty Type. Valve closes automatically

the instant a boiler tube or steam main bursts, prevents live steam from flowing into a cold boiler. Can be closed by hand at the valve or from a distance by operating a small valve.



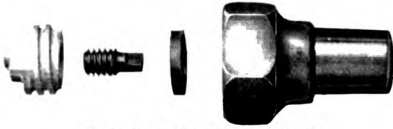
Emergency Stop Check Valve

The Schutte Engine Stop Systems protect fly wheel explosions and over speeding of engine. Can be operated in three distinct ways, electric, either open or closed circuit, mechanically, or by steam.

The Governor is set at a predetermined speed; the instant the engine reaches this point, valve is closed, thereby stopping engine.

Request Catalog.

## SCHUTTE & KOERTING CO.



Acid Chamber Spray Nozzle

We are the largest and most widely known manufacturers of **Acid Spray Nozzles**.

We make them in Platinum, Stoneware, Glass, Witclay, Rubber, Brass, Iron, Steel and Lead.

Our Spray Nozzles are adapted to the absorption of gases, washing and atomizing of chemicals.

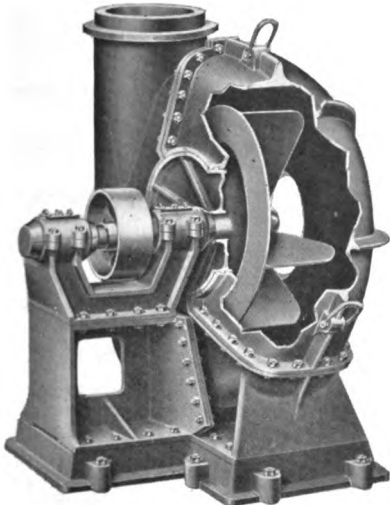
### CHEMICAL PLANT EQUIPMENT:

Acid Valves	Lead Exhausters
Air-Jet Lifts	Pumps—Centrifugal
Syphons—Acid	Blow Cases, Auto.
Blast Nozzles	Agitators
Blowers	Fans—Rotary Lead
Sulphur Furnaces	Heaters—Lead
Vapor Condensers	
Dust Collectors	

Apparatus for moving air and gases.

Spray nozzles for all chemical purposes.

Our New Lead Acid Fans shown below embody modern features which reduce speed and power, and overcome vibration, giving positive suction with maximum capacity.



Rotary Lead Acid Fan

### MARINE AUXILIARIES:

Evaporators	Distillers
Oil Coolers	Feed Water Heaters
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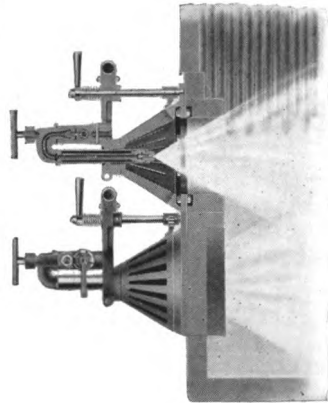
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The S. & K. Oil Coolers are used extensively in the steel mills and industrial plants for cooling the lubricating oils to turbine and engine bearings.



Fuel Oil Burners

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### THE KOERTING OIL BURNING EQUIPMENT:

Both for marine and stationary work, operates under forced or natural draft. High or low pressure air with or without steam.

All types of burners from 100 H. P. up. Also used on:

Annealing Furnaces

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We supply complete equipment from pumps to burners.

The Koerting types of burners are the Mechanical, Universal and Gravity.

The Mechanical having high pressure preheated oil.

Universal, low pressure oil and air.

Gravity, low pressure oil or gravity feed with low pressure air or steam.

## SCOTT VALVE MFG. CO.

DETROIT, MICH.

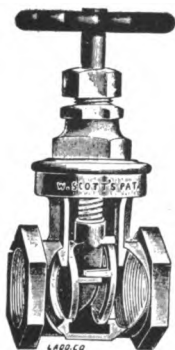
WESTERN BRANCH

Scott Valve Co., CHICAGO, ILL.

Manufacturer of Valves for Every Service

### SCOTT BRASS AND IRON BODY

**GATE VALVES** are made in three weights



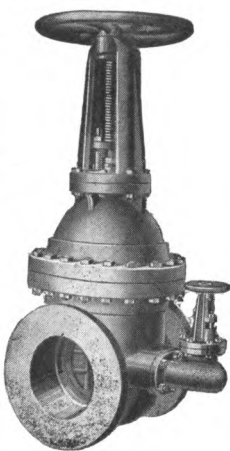
for standard, medium and extra heavy pressures. They are remarkable for their simplicity of construction designed with a

162

special view to strength and compactness, and are fitted with our Scott Double Disc Cylindrical

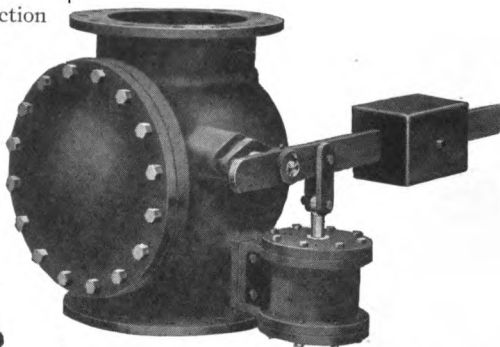
Wedge, which makes a full circular bearing upon the back of the disc or gate, thus insuring a perfect seating and the impossibility of the discs springing,

bending or getting out of shape.



### SCOTT WATER SEALED AUTOMATIC EXHAUST RELIEF OR BACK PRESSURE VALVES

are constructed to operate in exhaust mains between the low pressure cylinder and the condenser, and are so designed that should the condenser



fail to operate, and a back pressure form in the condenser the valve will automatically open, allowing the steam to escape into the atmosphere. All possible leaking of air which would tend to destroy the vacuum in the condenser is obviated by the water seal, and are positively noiseless under all circumstances while in operation. Made in all sizes to order.

*Blow-Off Valves, Sprays, Pipe Clamps, V-Notch Meters*

## YARNALL-WARING COMPANY

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CHESTNUT HILL, PHILADELPHIA

Branches and Representatives  
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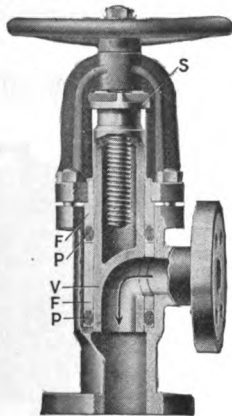
Manufacturers of YARWAY Power Plant Specialties

### YARWAY

*Power Plant Specialties are designed to promote economy and efficiency in the Power Plant.*

#### YARWAY (Formerly the Simplex) SEATLESS BLOW-OFF VALVE:

A blow-off valve unique in that it has no seat to wear down; that the packing is protected; that it will last for years without repacking or renewal.



In closing valve, shoulder "S" on plunger "V" engages the loose follower gland "F," compressing packing "P" above and below the port, making an absolutely tight valve.

Operation

A valve of unusual merit as proved by the increasing thousands in use.

#### YARWAY ADJUSTABLE SPRAY-HEAD (C. C. THOMAS PATENTS):

Adjustable to fit weather conditions. Operated from shore by a single handle for each row.

Any clogging material can be flushed out.

Can be set to secure maximum cooling range under any conditions of temperature or humidity.

#### YARWAY HYDRAULIC VALVE (CASKEY PATENTS):

For use wherever hydraulic machinery is used. A quick acting, easily operated valve that will withstand high pressure and heavy duty.

#### YARWAY (Formerly the Simplex) PIPE JOINT CLAMP:

Quickly and easily attached, even in out-of-the-way places. Will completely stop leaks. A power, coal and money saver.



#### YARWAY AUTOMATIC BOILER SKIMMER:

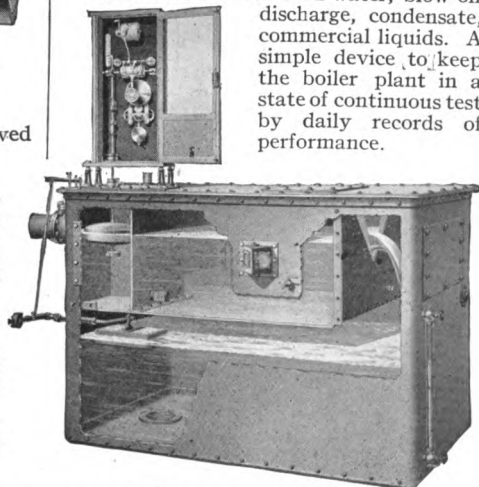
Prevents the formation of scale in the boiler by removing suspended matter in the feed water, continuously and automatically. One of the hundreds in use has been removing more than 2 tons of mud and scale matter per year from one boiler.

#### YARWAY STARTING AND PRESSURE UNLOADER (Richards Patents):

A power saver for the motor driven air compressor. Simple, automatic, cool-running and long wearing.

#### YARWAY-LEA V-NOTCH METER:

To measure boiler feed water, blow-off discharge, condensate, commercial liquids. A simple device to keep the boiler plant in a state of continuous test by daily records of performance.



#### BULLETINS AND INFORMATION:

About any Yarway specialties will be sent upon request.

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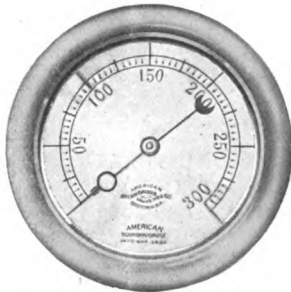
## AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

SALES OFFICES: NEW YORK, CHICAGO, ATLANTA, PITTSBURGH

**Manufacturers of Steam Traps, Gauges, Valves, Indicators, and Kindred Appliances for Governing, Indicating, Measuring, Recording and Controlling Steam, Water, Air, Gas, Oil, Ammonia, and All Other Pressures**

**AMERICAN GAUGES** are the simplest in construction, yet so designed that



Bourdon Gauge

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maximum efficiency with longest service is assured to the user. Gauges are too often judged or selected from superficial inspection only, with little or no attention to interior construction—the vital part. In American Gauges only the best material and workmanship will be found, as well as accuracy. This means dollars in every sense of the word to the owner in both operating and maintenance expense. We furnish gauges for every purpose, and especially invite inquiries for installations where operating conditions are unusually severe. Estimates promptly furnished.

### AMERICAN RECORDING GAUGES:

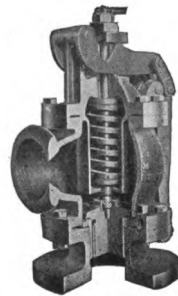
The economical operation of power is safely guarded by the use of accurate,



Recording Gauge

durable Recording Gauges. American Recorders are constructed in the same reliable, workmanlike manner that is characteristic of all our products. The style of case is the same as our non-recording instruments, thus giving uniformity to gauge board installations. Highest grade clock movements are used, insuring accurate time records. Standard chart 8 inch, 24 hour. Special charts to order. Each gauge fitted with our improved fountain pen requiring filling monthly. We specialize in engine room gauge boards complete, and invite inquiry.

### AMERICAN SPECIAL POP SAFETY VALVE:



Sectional View

This valve is designed embodying the best features found in our experience during the thirty years of spring loaded safety valve existence. Constructed of the highest grade materials, tested under actual working conditions, simple, efficient, and of few working parts, all being easily accessible, and *all* adjustments made from *outside* valve casing. It is the best in valve construction.

This valve is also made in outside spring pattern for superheated steam.

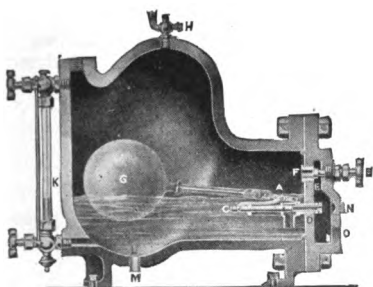
*Our sixty-eight years' record is behind our guarantee covering all goods which we manufacture.*

# AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

Established 1851

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

## AMERICAN IDEAL STEAM TRAP:

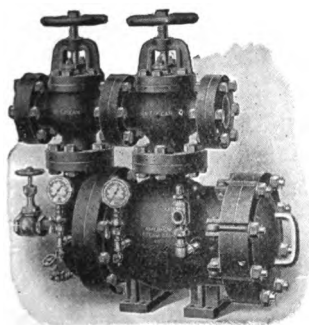


Model C—Sectional View

The essential feature of this trap is its valve leverage, which is many times more powerful than in any other Float Trap. This permits the use of floats sufficiently heavy to prevent possibility of collapse, and we make positive guarantee to this effect when traps are used on pressures for which they are intended.

The features of construction of this trap, both as regards valve leverage and design of shell or casing, insure unusually low upkeep or maintenance, and absence of trouble in operation.

## AMERICAN H<sub>2</sub>O GREASE EXTRACTING FEED-WATER FILTER:



Grease Extracting Feed-Water Filter

Designed for the efficient removal from feed water of grease which, after slight boiling, adheres in the form of "slugs" to boiler shell and flues. This filter has a filtering surface many times greater than area of the feed-water pipes, and occupies small space.

**OPERATION**—Under double filtration, filtering cages are covered with two layers of "Turkish toweling," which cloths are to be changed as often as conditions require. Temporary cleaning, however, may be effected by applying a reverse current of steam and drawing off the oil and grease while filter is in service. See illustration. Further particulars sent on request.

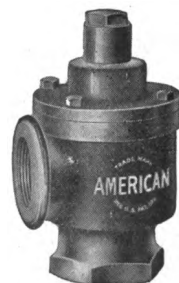
## AMERICAN RELIEF VALVES:

Iron Body Brass Mounted

165



Approved Underwriter



Standard

All Brass



For Small Pumps



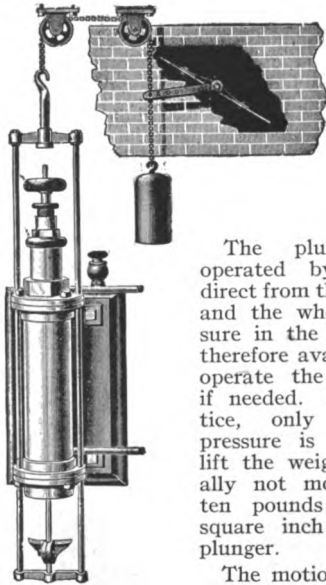
For Tanks, Etc.

## JULIAN D'ESTE COMPANY

26 CANAL St., BOSTON, MASS.

Brass Founders, Finishers and Machinists.  
Sole Manufacturers of Curtis Engineering Specialties

### THE CURTIS IMPROVED (PATENT) DAMPER REGULATOR:



166

Damper Regulator

The motion of the damper will begin to change from one direction to the other on a minimum variation of steam pressure.

We guarantee a saving of ten per cent of the fuel over the best hand regulation or the old style (diaphragm and lever regulator), and it often reaches fifteen per cent.

They are sent on thirty days' approval and will pay their cost by the saving of fuel in one year. Three Standard Sizes, 1, 2 and 3.

### IMPROVED STEAM PRESSURE REGULATORS:

This regulator is made entirely of metal; occupies the same space as a globe valve for the same size pipe; is a lock valve and is very simple and sensitive. Each size is made to a standard gauge; any injured piece can be replaced at a moment's notice.

For universal applications to all the varied and various conditions under which a reduced pressure of steam is required, this Regulator has no equal. It is compact and self-contained, without levers, weights or projections.

This regulator is suitable for boiler pressure up to 250 pounds and will deliver accurately and uniformly any lower pressure from one to within a few pounds of the initial pressure.

In the best engineering practice the exhaust steam of the engine and elevator is turned into the heating system of a building, and the Regulator automatically supplies just the amount lacking to maintain constant pressure in the pipes and radiators.

It has no glands or packing; no drip or leak of steam or water. All that passes into it passes through it without waste or loss.

It is used on steam heating apparatus, slashers, jacket kettles, air and water pumps; on steamships for deck machinery, pumps supplying steam to engines at lower than boiler pressure, or in any place where it is desired to reduce from a high pressure to a lower pressure. In pulp and paper mills, on digestors and on the dryers, it is highly recommended and can be used in connection with exhaust steam, and we can guarantee perfect work and scientific drying of all grades of materials.



Steam Pressure Regulator

Standard sizes for  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ " screwed-all bronze. 2" screwed, cast iron body, bronze mountings.  $2\frac{1}{2}$ ", 3", 4", 5", 6", 7", 8", 10" and 12" cast iron body, bronze mountings, extra heavy standard flanges.

A lockup top furnished at small additional cost.



# JULIAN D'ESTE COMPANY

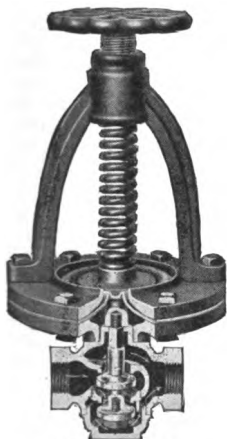
26 CANAL ST., BOSTON, MASS.

Manufacturers of Damper Regulators, Hydraulic Damper Regulators, Improved Pressure Regulators, Improved Pump Regulators, Water Pressure Regulators, Expansion Trap, Return Steam Trap, Balanced Steam Trap, Balanced Valves, Relief Valve for Steam and Water, Steam Separator, Temperature Regulator, Pump Governor and Pump, Blower Valve, U. S. Ball Cock, Etc.

## CURTIS WATER PRESSURE REGULATOR:

For Pulp and Paper Mills, Hotels, Public Buildings and Dwelling Houses.

EVERY REGULATOR IS WARRANTED to maintain the pressure desired, with perfect uniformity, regardless of any and all fluctuations in the outside pressure.



Curtis Water Pressure Regulator

Every part of the regulator which comes in contact with the water (except the diaphragm) is made of the best composition, so that trouble with rust or clogging with sediment is entirely avoided. The material and workmanship cannot be excelled, our aim being to produce a machine unapproachable in point of excellence, and practically imperishable working parts, at the lowest price consistent with such quality and excellence.

This regulator is guaranteed to deliver water into service pipes at any desired pressure, and, however the outside pressure may fluctuate, will deliver uniformly and permanently at the point at which it is set.

Pressure reduced to the point found to be sufficient for domestic purposes prevents flying and spattering, and consequent waste of water; obviates the wear and tear by water-hammer or concussion in pipes, and thereby greatly reduces the cost of keeping the plumbing in order.

Made for  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ ", 2" and  $2\frac{1}{2}$ " pipe, screwed.

Made for 3", 4", 5", 6", 7" and 8" pipe, flanged.

## THE CURTIS BALANCED STEAM TRAP:

### Some Points of Superiority

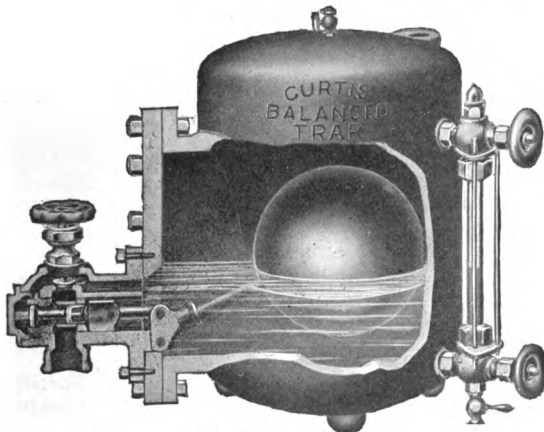
1. A perfectly balanced valve.
2. An absolutely frictionless valve.
3. The valve can be removed without breaking a joint, starting a gasket, or taking out a bolt.
4. The valve being frictionless and balanced, the whole power of the float is available for opening and closing it.
5. The copper float is perfectly spherical, as hermetically sealed as a glass globe, is of uniform thickness and warranted strong and tight at 250 lbs. pressure.
6. It has a pass-by valve to insure constant operation.
7. Each trap will operate perfectly on pressures varying from one to 250 pounds.

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### PRICE LIST

Size and Condensing Capacity in Feet of One-Inch Pipe

No. 000,	for 1,000 ft.	$\frac{1}{2}$ in. inlet and outlet
No. 00,	for 2,000 ft.	$\frac{3}{4}$ in. inlet and outlet
No. 0,	for 3,000 ft.	$\frac{1}{2}$ in. inlet and outlet
No. 1,	for 5,000 ft.	$\frac{3}{4}$ in. inlet and outlet
No. 2,	for 8,000 ft.	1 in. inlet and outlet
No. $2\frac{1}{2}$ ,	for 15,000 ft.	$1\frac{1}{4}$ in. inlet and outlet
No. 3,	for 30,000 ft.	$1\frac{1}{2}$ in. inlet and outlet
No. 4,	for 40,000 ft.	2 in. inlet and outlet
No. 5,	for 60,000 ft.	3 in. inlet and outlet
No. 6,	for 95,000 ft.	4 in. inlet and outlet



Balanced Steam Trap

## THE DOLE VALVE CO.

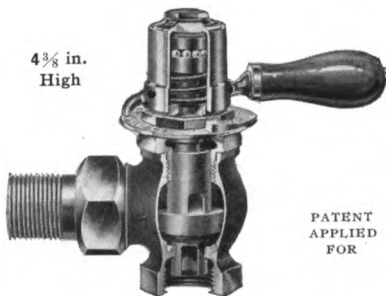
208 N. WELLS STREET, CHICAGO, ILL.

Manufacturers of Packless Radiator Valves & Double Compression Couplings

### DOLE PACKLESS GRADUATED VALVE:

The Ideal Valve for Vacuum or Vapor Steam Heating

The Dole Graduated or Modulating Valve is as carefully built as a watch—and as easily understood. Placed at



Dole Graduated Valve (Sectional View)

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the top of the radiator—where it is easily accessible without stooping—any degree of heat can be obtained with less than a half turn of the handle. Besides being the best-looking modulating valve, the Dole is the best constructed. Its packless feature—which has proved its utter practicability in over 250,000 installations—guarantees against leakage.

A short study of the sectional view shown will prove that in designing the Dole Packless Graduated Valve we have mastered all requirements necessary to make a perfect working Graduated or Modulating Valve.

#### Highly Finished:

The Dole Modulating Valve is heavily nicked and will retain its bright, handsome appearance indefinitely. Its exceptionally low height prevents it from protruding above the radiator.

#### Packless:

A feature which has made the Dole a permanently leakless valve. Overcomes the "packing-in-the-stuffing-box" method of construction which has caused endless trouble and damage by its leakiness.

#### Durably Constructed:

The Dole Valve is designed for practically everlasting service. The casting is of the best steam bronze—every detail carefully machined. The handle is made of selected mahogany.

#### Ball-Bearing:

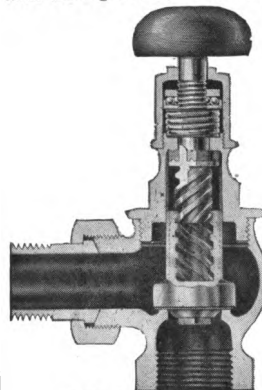
An exclusive feature. No matter how long the valve has been unused it can never stick or bind. When closed it shuts off absolutely tight.

Should any adjustment be desired after the valve is fitted and installed, all that is necessary is simply to loosen octagon nut on top of dial with special wrench, which is furnished for the purpose, turn dial to left to the desired point, then tighten nut. This adjustment is easily made while the steam is on.

Made in  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ " and 2" sizes.

### DOLE PACKLESS RADIATOR VALVES:

Dole Packless Radiator Valves are made in Angle, Right-Hand Corner, Left-Hand Corner, Straight-way Globe, and Straight-way Gate Styles.



Dole Angle Valve (Sectional View)

The sectional cut shown illustrates clearly the quick-opening feature, the double spiral thread, the one-piece rotating stem of properly proportioned size, and the manner in which the stuffing box of the ordinary valve has been eliminated.

Specify Dole Packless Radiator Valves. They are fully guaranteed.

Send for our Catalogue.

# IDEAL AUTOMATIC GOVERNOR CO.

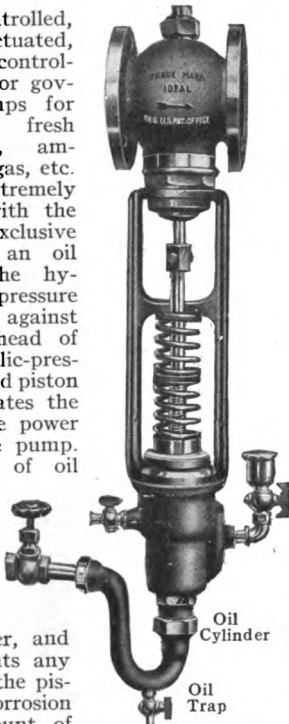
Incorporated

164 EMMET St., NEWARK, N. J.

Manufacturers of Pump Governors, Pressure Regulating and Controlling Valves and Ideal Automatic Piston and Valve Rod Packing

## "IDEAL" AUTOMATIC GOVERNORS:

are oil-controlled, piston - actuated, pressure - controlling valves for governing pumps for salt and fresh water, oil, ammonia, air, gas, etc. They are extremely sensitive, with the patented exclusive feature of an oil body in the hydraulic pressure cylinder, against the lower head of the hydraulic-pressure-actuated piston which operates the valve in the power line to the pump. This body of oil prevents the liquid being pumped from reaching the hydraulic-pressure cylinder, and thus prevents any sticking of the piston from corrosion or on account of grit or sediment in the liquid being pumped. An oil trap provides for settling of foreign matter, etc., and for retaining a sufficient body of oil in the cylinder to constantly bathe the cylinder walls, piston, and packing in lubricant. The material used in constructing governors for high duty service is Navy composition bronze or steel; for less exacting service steam composition or cast iron.

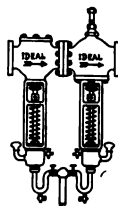


Style "A"

step-bearing pumps, hydraulic pumps, ammonia, gas and air compressors, and any other apparatus requiring sensitive, reliable automatic pressure control of steam, water or pneumatic power. They have been approved and adopted by the United States Navy and by the National Board of Supervising Inspectors of Steam Vessels for controlling salt water fire pumps, salt water sanitary pumps, bulk-head collision door pumps, fresh water pumps, clutch pumps, hydraulic pumps, ash pumps, forced feed lubricating pumps, ammonia and air compressors, etc.

Special adaptations of the "Ideal" Automatic Governor have been made for a variety of purposes, including a stop valve for cutting off flow from pump when pressure falls or vacuum is broken, by a break in delivery or suction line (Style C-S); a high pressure bypass relief valve taking pressure from accumulator side and by-passing when full travel of accumulator is reached or by-passing to atmosphere when electrically pumped liquids exceed maximum desired pressure (Style A-R); a double-safety, combining the principles of Styles A and C-S, providing automatic pressure control, and stopping pump if accident causes the pressure to fall below a fixed minimum (Style A-C-S); and many others.

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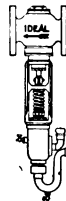
Style A-C-S



Style C-S



Style B-1 A



Style A-R

Write for descriptive bulletins, showing all styles, and supply data regarding desired sizes, pressure to be controlled, purpose, etc., for prices.

## ILLINOIS ENGINEERING COMPANY

GENERAL OFFICE AND FACTORY: CHICAGO  
Steam Heating Systems, Automatic Steam Power Specialties  
Branches and Representatives

CANADIAN OFFICE: TORONTO, 111 KING STREET, EAST

BIRMINGHAM, 320 Brown-Marx Bldg.  
BOSTON, 141 Milk Street  
BUFFALO, 756 Washington Street  
CLEVELAND, 412 Century Bldg.  
DENVER, 420 Century Bldg.  
DALLAS, 207 Gaston Bldg.  
DETROIT, 1919 Ford Bldg.  
HARRISBURG, 214 North Third St.  
INDIANAPOLIS, 1224 State Life Bldg.  
KANSAS CITY, 410 E. 43rd St.  
LOS ANGELES, 1101 Baker-Detwiler Bldg.

MILWAUKEE, 342 Fourth St.  
MINNEAPOLIS, 804 Metropolitan Life  
NEW YORK, 838 Singer Bldg.  
OMAHA, 728 World-Herald Bldg.  
PHILADELPHIA, Commonwealth Trust Bldg.  
PORTLAND, 68 N. Twelfth St.  
RICHMOND, 832 E. Main St.  
ROCHESTER, 404 Cox Bldg.  
SAN FRANCISCO, 559 Pacific Bldg.  
ST. LOUIS, 1308 Olive St.

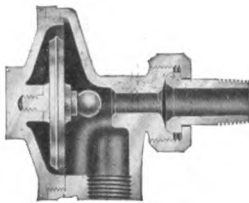
### ILLINOIS STEAM HEATING SYSTEMS:

#### VACUUM—VAPOR—MODULATING

Illinois Heating Systems are the highest development of modern heating, and are the result of over two decades of specialized work in the heating field.

170 Illinois Systems are successfully installed in thousands of buildings from Coast to Coast.

We manufacture a full line of Vacuum and Vapor Specialties, also Steam Specialties, and maintain an efficient Engineering Department to assist Architects and Engineers in the proper installation of our devices.

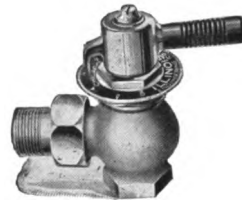


Thermo Trap

All Illinois Systems, whether Vacuum or Vapor, use our Thermo Trap on all radiators. This Trap has many exclusive advantages as will be seen in cut of same. It is the original Vertical Seat Trap, thus avoiding trouble from stoppage by dirt.

The diaphragm is carefully made of 90,000 lbs. tensile strength Phosphor Bronze and the durability of these is such that, under our three-year guarantee, the number of renewals is practically nil.

The Thermo Trap is sensitive and positive in operation. It is made in four sizes with a range in capacities from 50 sq. ft. to 1500 sq. ft. of radiation.



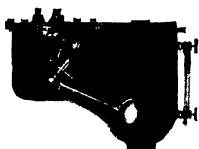
Supply Valve

The Illinois Modulating Supply Valve, usually placed at the top of the radiator where easily accessible, controls the supply of steam to the radiator by only a half turn of the handle from closed position to full open. This gives a ready means for controlling the temperature of the room. These valves, like all our products, are heavy and of rugged construction, to insure durability. A graduated dial shows position of valve.

We make all necessary accessories for Vacuum Heating Systems, Vacuum Pump Governors, Suction Strainers, Expansion

## ILLINOIS ENGINEERING COMPANY

Joints, Air Liberating Tanks, etc., of various capacities.



Return Trap

Also for Vapor Systems, we manufacture the Illinois Return Trap, for returning water of condensation to the Boiler against pressure—a necessary part of any successful Vapor System.

The Illinois Air Vent Seal vents air from the System at two or three ounces pressure, and positively prevents air pulling back into the System when operating on Vapor.



Air Liberating Tank

For use on discharge pipe between Vacuum Pump and Boiler, for Automatically venting air from a Vacuum System without escape of water.

All our Illinois Heating Specialties are time-tried and of superior merit, and we guarantee them to operate properly.

*Write for Bulletin No. 10 for detail data concerning these specialties.*

**Write for 88 page Catalog descriptive of Illinois Heating Systems.**

(Continued on next page)

*Eclipse*

### STEAM SPECIALTIES:

We manufacture the Eclipse Steam Specialties, established by John Davis Co. Many of these devices have been on the market 35 years.

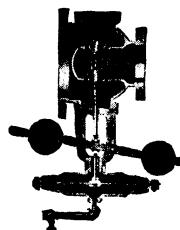
### PRODUCTS:

Pressure Reducing Valves, all types.  
Back Pressure Valves.  
Atmospheric Relief Valves.  
Stop and Check Valves.  
Steam Traps.  
Oil and Steam Separators of all types.  
Cast Iron Exhaust Heads.  
Blowoff Valves.  
Safety Water Columns, etc.

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### PRESSURE REDUCING VALVES:

For all pressures and services, the cumulative experience of 35 years has perfected these valves.



Vacuum Type Reducing Valve

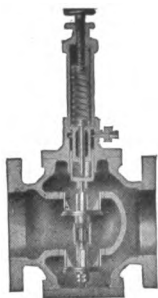
The Eclipse Vacuum Type Reducing Valve will regulate and hold the reduced pressure within a 4 oz. limit. Will reduce from an initial pressure as high as 150 lbs. to any reduced pressure from 10 lbs. to  $\frac{1}{4}$  lb. This valve is ideal for

(Continued from preceding pages)

## ILLINOIS ENGINEERING COMPANY

use in Vacuum Heating Systems, where a constant low pressure is desired, and it is used on hundreds of important buildings.

The Eclipse Adjustable Piston automatically compensates for variations in pressure insuring tight closing, and is exclusive to Eclipse Valves.



High Pressure Reducing Valve

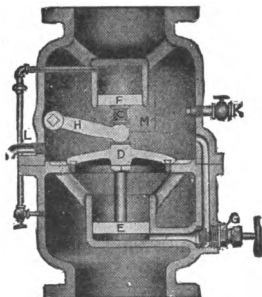
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The Eclipse High Pressure Reducing Valve is spring controlled, and will reduce from 250 lbs. pressure down to 10% of the initial pressure. This Valve will close tight and will not leak to build up pressure on a dead end.

We manufacture other Reducing Valves for all classes of service in controlling pressures in steam, air or water. Consult us upon your requirements.

### BACK PRESSURE VALVES:

Of all types.



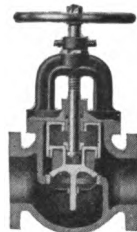
Combination Atmospheric Relief and Back Pressure Valve

Combination Atmospheric Relief and Back Pressure Valves (see cut) for plants operating both condensing and non-condensing, or wherever precise regulation of back pressure is desired. Built under Hockfeldt Patents.

Balanced, bevel-seated Valves, both spring controlled or lever and weight controlled.

Atmospheric Relief Valves for safeguarding engines and turbines run condensing.

### NON-RETURN VALVES:



Non-Return Valve

Eclipse Stop and Check Valves have several exclusive points of merit. They are of heavy construction for 250 lbs. working pressure, the large internal dash pot is independent of the body, the piston is reinforced with 4 ribs—not a plain rod as usual, and the Valve can be packed while in service under pressure. They do not stick or chatter. Also built with steel bodies and monel parts for Superheated Steam.

Write for Bulletins covering the above valves and other Eclipse Steam Specialties.

Pressure Regulating Valves, Bulletin 101  
Back Pressure Valves, Bulletin 201  
Steam Traps, Bulletin 301  
Non-Return Valves, Bulletin 451  
Extra Heavy Globe and Angle Valves, Bulletin 451  
Steam and Oil Separators, Bulletin 501  
Pump Governors, Boiler Trimmings, Bulletin 701

Representatives in 20 principal cities.

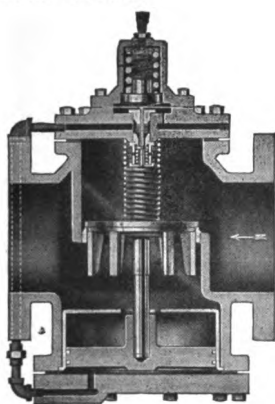


## KIELEY AND MUELLER, INC.

34 WEST 13TH ST., NEW YORK CITY

**Manufacturers of a Complete Line of High Grade Steam, Water and Air Specialties for Modern Heating, Power and Plumbing Installations**

### KIELEY HIGH PRESSURE PILOT REDUCING VALVE:



No. 154

Kieley High Pressure Pilot Valves are suitable for marine service, where it is necessary to reduce high steam pressures for operating donkey engines, steering and hoisting engines, high speed electric generator engines, heating systems or other steam appliances used in connection with steam boats or power plant work.

Valve will positively respond to the slightest variation in pressure and will absolutely maintain the pressure at which it is set, regardless of what variation takes place in the initial pressure.

**Working Pressures**—Initial pressures, 250 lbs. or less. Minimum delivery or reduced pressure, 10 lbs. Maximum reduced pressure 90 per cent of the initial pressure.

**Construction**—For general use the valve bodies are made of the best quality of cast iron, and interior working parts of government bronze.

For extra high pressures or superheated steam work we construct the valve bodies of cast iron or cast steel with monel metal or nickel seats and discs. Prices furnished on application.

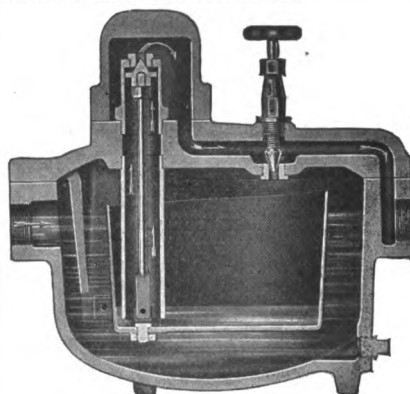
### KIELEY EASY REPAIR STEAM TRAP:

**Construction**—The Kieley Easy Repair Trap is the latest development in the art of steam trap construction. The important parts and those subjected to the greatest wear are placed high in the top of the trap so that by removing two nuts and the small cap all the parts are accessible and easily removed for repairs. Please note that all of this can be done without having to break any of the pipe connections or remove the cover.

In addition to the above advantages, which are strong points in favor of our traps, we construct the seats and discs of our standard traps

of government metal, which is considered the highest grade metal in existence, absolutely non-corrosive, and for excessive high pressure or superheated steam work the seats and discs are constructed of nickel or monel metal, and the bodies of cast iron.

The valves in our traps close off absolutely tight and on account of their being protected by a water seal makes it impossible for any steam to escape from them when in service. This fact alone ought to be sufficient to assure the adoption of our traps in preference to all others, as a leaky trap is one of the most expensive devices you can have in your plant. All parts of our traps are interchangeable and can be obtained at a minimum cost.



No. 702

### OTHER PRODUCTS:

Reducing Valves for steam, water, air, etc.  
Back Pressure Valves for all purposes.  
Atmospheric Relief Valves for all purposes.  
Steam Traps for all purposes.  
Damper Regulators of various kinds.  
Hot Water Temperature Controllers.  
Steam and Water Separators.  
Oil and Grease Extractors.  
Pump Regulators.  
Water Pressure Regulators.  
Water Feeders.  
Return Steam Traps.  
Feed Water Regulators.  
Grease and Oil Traps.  
Emergency Valves.  
High and Low Water Alarms.  
Strainer Connections of various kinds.  
Drip Tank Controllers.  
Float Valves.  
Tank Pump Controllers.  
Pump Governors and Receivers.  
Combination Muffler and Grease Extractor Tank, Receiver, Pump Governor, Pump and Feed Water Heater.  
Grease Extractor and Purifier.

**NOTICE**—Trade Mark "KIELEY" appears on all our specialties, and they are known by that name. Kindly order or specify accordingly.

NEW COMPLETE CATALOGUE SENT ON REQUEST.

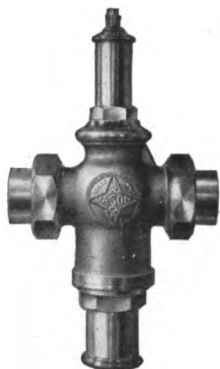
## MASON REGULATOR CO.

BOSTON, MASS.

Manufacturers of Regulating Appliances

### REDUCING VALVES:

Reduce and maintain an even pressure of steam or air regardless of the variation of the initial pressure or of the volume of steam or air required. Automatically reduce boiler pressure for steam heating systems of all types (vacuum systems



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Standard Reducing Valve

included), central heating plants, engines, paper machines, slathers, dye kettles and all situations where it is desirable to use a lower pressure than that on the boiler.

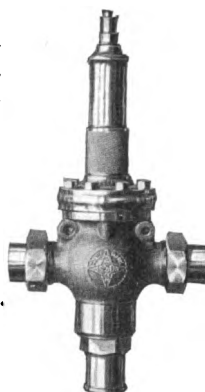
Furnished in the auxiliary operated, lever and weight, and other types. All-bronze for initial pressures of 300 lbs., and iron body for pressures up to 180 lbs.



Reducing Valve, Lever Style

### STEAM PUMP PRESSURE REGULATORS:

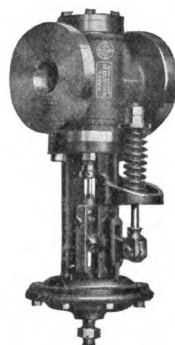
Designed for fire, boiler feed, air and water works pumps, or any class of pumping machinery where it is necessary to maintain constant pressure. They are placed in the steam supply pipe to the pump, and connected by a  $\frac{1}{4}$ -in. pipe to the discharge system, thereby exactly regulating the amount of steam to the requirements of the pump, and automatically maintaining a uniform discharge pressure regardless of any variation of steam pressure or demand on the pump.



Key Style  
Steam Pump Pressure  
Regulator

The key style regulator is provided with a dashpot, which positively prevents it from chattering or pounding when sudden changes occur in the discharge pressure. It is fitted with union connections threaded for standard wrought iron pipe. As regularly furnished, it is suitable for steam pressures up to 250 lbs. and discharge pressures between 20 and 140 lbs.

No. 126 regulator has been designed for closed systems, such as are used in supplying domestic service or larger pressure systems for office and factory buildings up to 150 lbs.



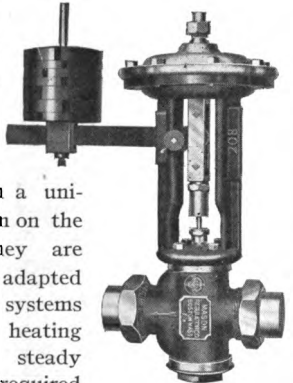
No. 126 Regulator



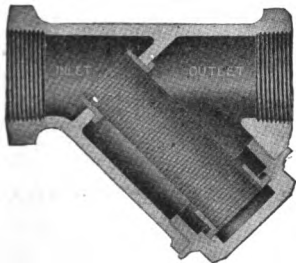
## MASON REGULATOR CO.

### STEAM VACUUM PUMP REGULATOR:

Designed to control steam operated vacuum pumps so as to maintain a uniform vacuum on the system. They are particularly adapted to vacuum systems of steam heating where a steady vacuum is required and an automatic pump control is desirable. The regulator consists of a balanced type of double seated valve connected to a diaphragm operating against the action of the weights, thereby regulating the steam supply to the pumps. Suitable for steam pressures up to 180 lbs. and adjustable for any desired vacuum.



Steam Vacuum Pump Regulator



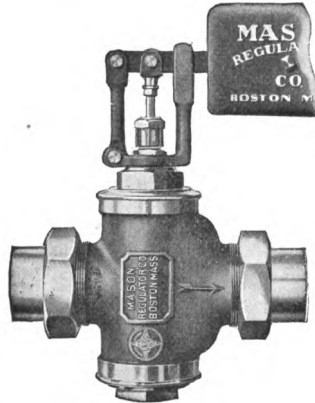
Strainer

Sizes,  $\frac{1}{2}$  in. to 6 ins.

For use on steam or air lines to prevent sediment, scale, bits of packing or other foreign material passing into the reducing valve or other pressure regulator installed on the line, assuring the user of continuous service. Constructed not to reduce the volume of steam or air passing through them, yet are compact and self-cleaning without removing them from the line.

### BALANCED AND FLOAT VALVES:

Used to control pumps, engines and the like, by means of tank floats or cords to distant points and also in connection with various devices for the control of water to receivers, open heaters and other



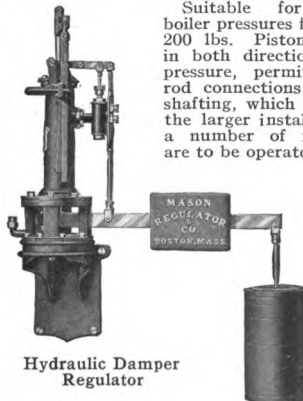
All-Bronze, with Yoke and Lever

similar devices. They are made in both the double seated or disk and piston type, with weight and lever or float attachment. Regularly furnished extra heavy, suitable for pressures up to 200 lbs.

### HYDRAULIC DAMPER REGULATOR:

The design of the compensating device, which is positive in its action, insures the closest possible regulation. The operating cylinder as well as all parts coming in contact with the water are made from high pressure bronze and carefully machined to obtain the greatest durability and sensitive action of the apparatus. The knife edges and fulcrum points of the lever are also of special construction.

Suitable for controlling boiler pressures from 1 or 2 to 200 lbs. Piston is operated in both directions by water pressure, permitting use of rod connections to overhead shafting, which is desirable in the larger installations where a number of flue dampers are to be operated in unison.



Hydraulic Damper Regulator

## THE LESLIE COMPANY

LYNDHURST, N. J.

Founders and Manufacturers

### PRODUCTS:

"Leslie" Patent Pressure Regulator  
Patent Removable Coupling Nuts and Sleeves  
Bronze and Composition Castings  
Engineering Specialties  
High Pressure Steam Fittings, Etc.

### THE "LESLIE" PATENT PRESSURE REGULATOR: (For Steam or Air)

#### Class "E," Bronze:

176 The "Leslie" Pressure Regulator, Class "E," is especially designed to deliver any desired pressure from a minimum of about ten pounds up to a maximum of 85 per cent. of the initial or boiler pressure up to 350 pounds per square inch, for all kinds of service, both in Marine and Stationary Service, including Saturated or Superheated Steam, Compressed Air and Oil under pressure to Burners, Journal Bearings, etc.

All "Leslie" Pressure Regulators, Class "E," are made in standard sizes from  $\frac{1}{2}$  inch to 20 inch, inclusive, and are made exclusively of our special high pressure Steam Bronze throughout, except Springs, Bolts, Nuts and Capscrews. The Springs are made of a special steel and are made exclusively for the "Leslie" Pressure Regulators, and are then specially nickel plated.

Our Class "E" Regulators have met the most exacting and searching tests up to 500 pounds Hydrostatic, and 350 pounds working Steam Pressure, exacted by the United States and Foreign Navies, and in service where all other makes had failed they have proven so successful that they are specified by the leading Naval Architects, Marine Engineers and Mechanical Engineers, as well as the largest users of Reducing Valves in the world, who not only specify them, but insist upon "Leslie" Valves being installed.

#### Class "F," Iron Body:

Our Class "F" Regulators are designed for Stationary Service where Superheated Steam is not used and where the initial or boiler pressure does not exceed 200 pounds per square inch, and the reduced pressure to be delivered is not less than 10 pounds per square inch.

Similar in design to Class "E," except that it has a Bronze Liner in Cylinder and Bronze Main Valve Seat in Body, and is especially adapted to meet the growing demand for a **reliable** Reducing Valve in the **Stationary** Service. The Main Body, Top and Bottom Caps are made of a special high grade Cast Iron, **all other parts** of high pressure Steam Bronze, same as used in Class "E" Regulators, and are made in standard sizes from 4" to 20", inclusive.

Our Class "F" (Iron Body) Regulators can be found in the largest and most important Power and Steam Plants, Mills, Manufacturing and Mining Plants in this and foreign countries, where they have given results so satisfactory, that **we guarantee** them to do the work, for which they are intended, satisfactorily to our customers.

#### Class "H," Steam Heat Service, etc.:

Our Class "H" Regulators are designed for Steam Heat Service in Buildings, Compressed Air, Oil under pressure, etc., where the reduced pressure to be delivered is not less than 2 pounds nor more than 10 pounds per square inch.

Made in standard sizes from  $\frac{3}{4}$ " to 10", inclusive. From  $\frac{3}{4}$ " to 5", inclusive, they are made of the highest grade high pressure steam bronze throughout; above 5" they are made of a special high grade Cast Iron with Bronze fittings.

PACIFIC COAST AGENTS

Chas. C. Moore & Co., Engineers  
San Francisco, Cal.

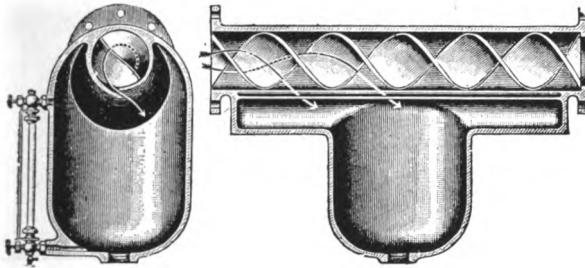
## UNITED MACHINE & MFG. CO.

CANTON, OHIO

Manufacturers of Steam and Oil Separators, Special Machinery, Die Making;  
Contract Machine Work

### THE MOSHER SEPARATOR:

For Separating Water or Oil from Live Steam, Exhaust Steam, Compressed Air, Ammonia and other Gases.



### OPERATION:

The steam, in passing through the separator, is caused to revolve many times around the spiral, whence any foreign matter that is heavier than the steam is thrown outward by centrifugal force where it is acted on again and again by the overlapping edge of the slotted openings through which the water, oil or other matter separated is delivered to the collecting chamber below, and is entirely isolated from the currents of steam and cannot be again picked up and carried along. The passage of the steam through the separator is free and unobstructed and causes no back pressure.

### SOME POINTS OF ADVANTAGE:

No cross baffles to cause loss of pressure. An easy, straight through passage for the steam. Water is not pulverized by obstructions and carried along as mist. Matter once separated remains so.

No expansion chamber necessary to slow down velocity.

We do not depend on gravity for separation, as we employ centrifugal action, a force many times in excess of gravity. What chance has a drop of water to fall against a 60 mile gale (the ordinary steam pipe velocity)?

We include a number of separators for the price of one.

Every time the whirling column of steam passes that edge separation takes

place. Matter once shaved off by that edge never again comes in contact with the moving column of steam.

It can't be picked up.

It is in a separate chamber isolated from the steam.

Our oil separator is not as big as a house; velocity helps us, not hinders.

Absolutely self-cleaning, the action of the steam continually scrubs the surfaces.

They are built in our own plant, and we can guarantee material, workmanship and delivery on short notice.

### APPLICATION:

As an Oil Separator where the quantity of liquid is usually small in proportion to the amount of gas.

For places where the space is limited, <sup>177</sup> it takes up practically no more space than the pipe itself and its flanges.

It may be applied inside a boiler to take care of excessive priming.

Between boiler and engine.

Between engine and condenser.

Between high and low pressure cylinders.

Between reciprocating engines and low pressure turbines.

On superheated lines to take care of slugs of water.

On vacuum pans and other evaporating apparatus.

On long lines of pipe.

On steam lines to dry houses, etc., removing the moisture increases efficiency.

For separating oil, grit and moisture from compressed air.

For separating tar from gas mains.

For ice and refrigerating plants.

For use on steam turbines.

For increasing the efficiency of steam hammers, etc.

For use where steam is supplied from street mains.

As an oil and grease extractor.

Have our engineers study your problem and advise you of the best installations.

Write for illustrated literature.

## THE POWERS REGULATOR CO.

2161 Mallers Bldg.  
CHICAGO

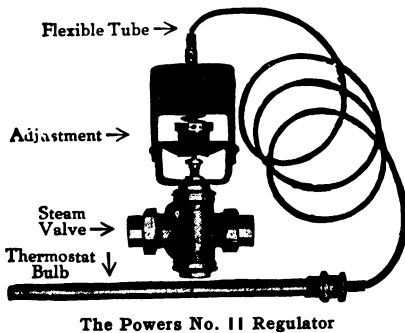
972 ARCHITECTS BLDG., NEW YORK

383 Federal St. Bldg.  
BOSTON

The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

Specialists in Automatic Heat Control

### THE POWERS NO. 11 REGULATOR:

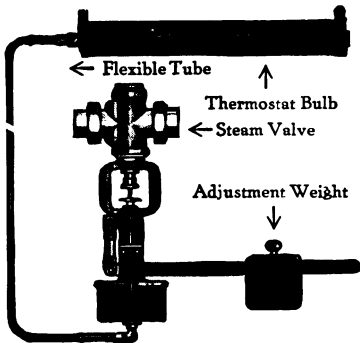


The Powers No. 11 Regulator

For the control of liquid temperatures —water cooling, water heating, steam cookers, pasteurizers, and baths, hot water tanks, cooling water tanks, feed water heaters, glue heaters, etc. All metal construction. Entirely automatic and self-contained. Ask for Bulletin 129.

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### THE POWERS NO. 15 REGULATOR:



The Powers No. 15 Regulator

For control of air temperatures. The thermostatic bulb is so constructed that it may be placed at any point and in any position in the room to be controlled, and connected with the steam valve by a flexible tube, of any required length. It is very sensitive and reliable. Self-contained, and entirely automatic.

### THE POWERS NO. 16 REGULATOR:

The No. 16 is particularly effective for control of liquids in open tanks, cooking vats, hog scalders, scrapers, tripe wash-

ers, etc. Self-contained. Automatic. Reliable. Ask for Bulletin 139.

### THE POWERS WATER CONTROLLER:

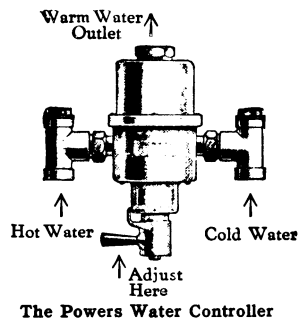
The Powers Water Controllers are true automatic thermostatic mixers, not to be compared with mechanical mixers, anti-scald valves, etc. They are built in several sizes for bath rooms, showers (singly, or in gangs), water line control, etc. Another type provides for a wider range of control, especially adapted to certain industrial processes. Ask for Bulletin 124.



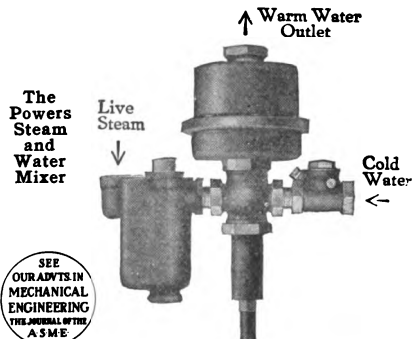
The Powers No. 16 Regulator

### THE POWERS STEAM AND WATER MIXER:

The Steam and Water Mixer is an instantaneous water heater, thermostatically controlled, making it absolutely safe against scalding. Mixes live steam and cold water. Adapted to wash sinks, showers, baths, etc., in industrial plants. The most economical installation for supplying hot water. Ask for Bulletin 137.



The Powers Water Controller

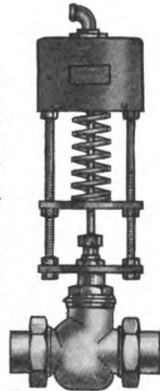


The Powers Steam and Water Mixer

## THE POWERS REGULATOR CO.

### THE POWERS PRESSURE REDUCING VALVE:

The Powers all-metal construction is here applied to pressure reducing valves, for steam, air, and water. Simple, durable, accurate, reliable. Effective regardless of varying initial pressures. Used with success on sterilizers, vulcanizers, cooking retorts, etc., etc. Ask for Bulletin 118.



The Powers Pressure Reducing Valve

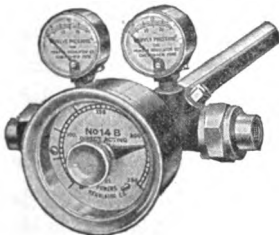
### THE POWERS ALL METAL VALVE:

The All Metal Valve is designed for thermostatic and pneumatic control of fluids. Adapted to a great variety of industrial processes. Is called *The Everlasting Valve*, because it is extremely elastic, and durable almost without limit. Recommended especially for the critical conditions where the rubber diaphragm proves unsatisfactory.



The Powers All Metal Valve

### THE POWERS NO. 14 REGULATOR:



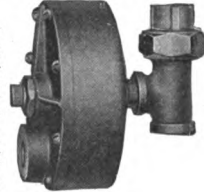
The Powers No. 14 Regulator

A temperature regulator of the air operated type, designed for use with humidity controlling systems, air washers,

pasteurizers, sterilizers, steam cookers, drying and cold storage rooms, japanning ovens, etc., etc. Very sensitive. Ask for Bulletin 132.

### THE POWERS HIGH PRESSURE STEAM TRAP:

A small and extremely efficient trap for apparatus using high pressure steam for heating sterilizers, vulcanizers, dryers, enameling ovens, steam kettles, steam tables, etc., etc. Absolutely positive in operation, discharging freely a large volume of water, but closing tight against steam above the stipulated pressure. Ask for Bulletin 115.

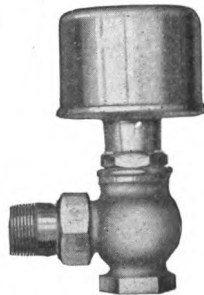


The Powers High Pressure Steam Trap

### CONTROL OF TEMPERATURE IN LIVING ROOMS:



The Powers Thermostat "D"



The Powers All Metal Radiator Valve

The Powers System of Temperature Control for living apartments, because of its great accuracy and durability, is particularly adapted to hospital buildings. May be installed in old or new buildings, for all or any portion of the rooms.

Special catalog "D" will be sent upon request.

The thermostat shown at left is typical of the Powers System. All Powers Thermostats are of the vapor disc type, exclusive with Powers, and always maintain their adjustment. The Powers All-Metal Valve shown at right is famous as *The Everlasting Valve*.

# SARCO COMPANY, INC.

WOOLWORTH BLDG., NEW YORK

PHILADELPHIA

BUFFALO

DETROIT

CLEVELAND

CHICAGO

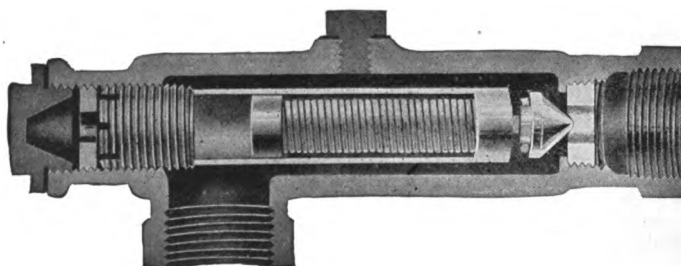
Steam Traps, Radiator Traps, Temperature Regulators, Metallic Gaskets

## STEAM TRAP SARCO:

The Steam Trap Sarco derives its operating force from the expansion and contraction of a heavy hydrocarbon oil

## High Pressure, 50 to 200 Lbs.

Size	List Price
3/8"	\$ 7.75
1/2"	7.75



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hermetically sealed in a cartridge. The trap requires simply to be put in position and the cartridge unscrewed a few turns. When the steam has heated the cartridge, expanding the fluid and forcing out piston, the cartridge is gently screwed forward, closing off the steam.

The adjustment can then be locked and the trap works automatically. As soon as water collects the operating fluid in the cartridge contracts and the valve opens discharging the water. Steam following the water expands instantly the operating fluid and closes the trap.

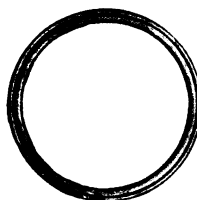
Owing to the principle of operation, no large storage capacity is required in the trap and this means a very small trap and low cost. The Sarco is the only thermostatic trap made for high pressure. It is connected straight on the line and requires no floor space or building up. It is, therefore, very easily installed.

## Low Pressure, 0 to 50 Lbs.

Size	List Price
3/8"	\$ 6.00
1/2"	6.00
3/4"	9.45
1"	11.25
1 1/4"	24.15
1 1/2"	30.00
2"	38.70
2 1/2"	51.75
3"	60.00

3/4"	10.35
1"	12.00
1 1/4"	28.50
1 1/2"	34.50
2"	48.30
2 1/2"	60.00
3"	75.00

## SARCO METALLIC GASKETS:



Are made for low and high pressure steam, superheated steam, oil, gas, water, and designed for union connections, flange connections,

or made in any special shape. They have an inner ring of lead, reinforced by an outside copper ring, which prevents the lead from being blown out by the steam or squeezed out when being compressed. For superheat concentric rings of soft copper are used.



# SARCO COMPANY, INC.

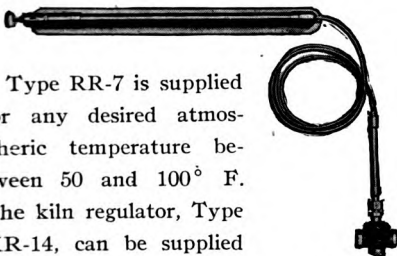
## TEMPERATURE REGULATORS FOR LIQUID AND ATMOSPHERE:



Type TR-21

Sarco Temperature Regulators derive their actuating motive power from expansion and contraction of a sensitive liquid hermetically sealed within the apparatus, and they require no exterior operating means. Sarco Regulators are made in three standard types; for room temperature control, for dry kiln work and for tank control. All are supplied for a given temperature and can be adjusted by

the user for any temperature 10° F. above or 10° F. below that for which the regulator is calibrated at the works.



Type RR-7 is supplied for any desired atmospheric temperature between 50 and 100° F.

The kiln regulator, Type KR-14, can be supplied for any desired temperature between 32° F. and 300° F. The tank regulator, TR-21, can be used for any desired temperature of liquids or atmosphere between 32° F. and 300° F.

Type KR-14  
Designed Specially for Dry  
Kiln Work

The tank regulator, TR-21, can be used for any desired temperature of liquids or atmosphere between 32° F. and 300° F.

Sarco Temperature Regulators of other types can also be made to meet special conditions.

Sarco Temperature Regulators are supplied with direct acting valves closing with rise of temperature or reverse acting valves, opening with rise of temperature. They control steam, water or gas lines. They are also supplied with electric switches instead of valves if so desired.

### Type RR-7 Sarco Temperature Regulator for Atmosphere up to 100° F.

Size of Valve	List Price
1/2".....	\$40.00
3/4".....	45.00
1".....	50.00
1 1/4".....	60.00
1 1/2".....	70.00
2".....	90.00

### Type KR-14 Sarco Temperature Regulator for Atmosphere up to 300° F.

Size of Valve	List Price
1/2".....	\$ 60.00
3/4".....	65.00
1".....	70.00
1 1/4".....	75.00
1 1/2".....	85.00
2".....	95.00
2 1/2".....	110.00
3".....	130.00
4".....	170.00

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### Type TR-21 Sarco Temperature Regulator for Liquids and Dry Kilns

Size Inches	Weight Pounds	List Price
1/2	8	\$ 75.00
3/4	8	80.00
1	9	85.00
1 1/4	13	90.00
1 1/2	22	95.00
2	28	100.00
2 1/2	37	115.00
3	51	135.00
4	81	185.00
5	132	250.00
6	158	300.00

## AMERICAN INJECTOR COMPANY

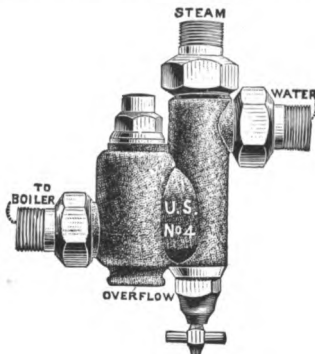
DETROIT, MICH.

**Manufacturers of Injectors, Ejectors, Jet Pumps, Drive Well Jet Pumps, Fire Plugs, Grease Cups, Oil Cups, Oil Pumps, Water Gauges, Air Cocks, Gauge Cocks, Lubricating Devices and Other Steam Specialties**

### U. S. AUTOMATIC INJECTORS:

Have the following points of unquestionable superiority:

1. Easy to Operate
2. Wide Range
3. Absolutely Automatic
4. Never "Break" through Jarring
5. Backed by an Absolute Guarantee
6. Every Injector Carefully Tested



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U. S. Automatic Injector—Regular Style

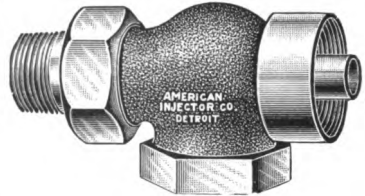
The utmost care is taken to see that every U. S. Injector leaving the factory shall be perfect in every respect. Each injector is tested on different lifts and with various steam pressures. A card is attached to the Injector showing its range, and we guarantee every Injector to work as per attached card.

**Other Distinctive Features are:** 1. The Drip-Cock. 2. The construction of disk valve on delivery tube, which, being cup shaped, is forced to rise to its seat by the jets of water thrown against it from beneath. 3. The overflow valve, which never wears leaky.

Sizes range from  $\frac{1}{4}$ "-3" pipe connection, with corresponding capacities of 36 to 5800 lbs. per hour at 80 lbs. steam pressure and three foot lift, water 76 deg.

**Special High Steam Injectors** to work to 300 lbs. steam pressure can be furnished to order. Also, injectors with special connections.

### AMERICAN EJECTORS (Model B):



American Ejector—Model B

The American Ejector, because of its internal construction, gives superior service in raising water from deep wells, mines and pits or emptying tanks, raising and transferring liquids (hot or cold) in tanneries, dyehouses, etc., or for priming centrifugal pumps.

The jets are made of a special hard bronze and can be renewed when worn, as the body of the Ejector will last indefinitely.

### GAS ENGINE "EXPLOSO" OIL CUP:



"Exploso"  
Oil Cup

"Exploso" Gas Engine Oil Cup is especially designed and manufactured for the class of trade demanding a Lubricator of the highest type. The filling arrangement consists of a sliding lid which makes the filling of the cup very simple and insures it being oil-tight. The sight feed opening is large and the shank is fitted with a large ball check valve to prevent back pressure entering the sight feed chamber.

With improved features an even, constant flow of oil to the cylinder is assured.

The rate of feed can be adjusted by the milled regulating screw and ratchet holding same to place.

*Catalogue No. 29, giving full details about U. S. Automatic Injectors and "The Engineers' Red Book," full of practical information for the Operating Engineer, will be promptly sent upon request.*



## PENBERTHY INJECTOR CO.

Established 1886

DETROIT, MICH.

N. Y. DEPOT  
71 BREKMAN ST.

BRANCHES:  
LONDON, ENGLAND

PARIS, FRANCE

CANADIAN PLANT  
WINDSOR, ONT.

**Manufacturers of Injectors, Ejectors, Valves, Cellar Drainers, Steam Specialties, Lubricating Devices and Carburetors**



### AUTOMATIC INJECTORS:

**Over a Million in Use**

All our claims for the "Penberthy" Injector are based on actual tests, as we have set for this machine a very high standard, which for years has been steadily advanced, and the "Penberthy"



Automatic Injector

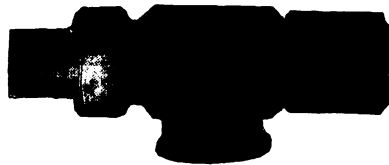
to-day is better than ever before. Every "Penberthy" Injector is tested on the following points:

*Start Low,* 20 to 22 lbs. steam on 3-foot lift.  
*Work High,* 165 to 170 lbs. steam on 3-foot lift.  
*Lift Water,* 20 to 24 feet on 60 to 80 lbs. steam.  
*Handles Hot Water,*  
125° to 130° at 60 to 80 lbs. steam.  
115° to 120° at 100 lbs. steam.  
95° to 104° at 125 lbs. steam.

### XL-96 EJECTOR SIPHON OR STEAM JET PUMP:

It would be difficult to enumerate all the uses to which our jet pump is adapted, but when we say that **anything and everything** in the nature of a liquid (if not too thick) **can be transported from one level to another, or horizontally almost any distance,** we have about covered the ground; therefore, the following factories, mills, etc., will see the advantage of

adopting them, *viz.*: Chemical Works, Creameries, Cheese Factories, Tanneries, Mines, Well Diggers, Brickyards, Gas Works, Paper Mills, Steamboats, Breweries, Distilleries, etc.

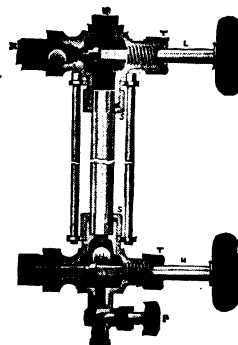


XL-96 Ejector

### SAFEGUARD AUTOMATIC WATER GAGE:

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A high grade bronze gage tested to 300 lbs. Each gage is thoroughly tested. Self-cleaning by the action of the blow-off vibrating balls. The cleaning stem in lower shank goes all the way through into the boiler, absolutely preventing opening



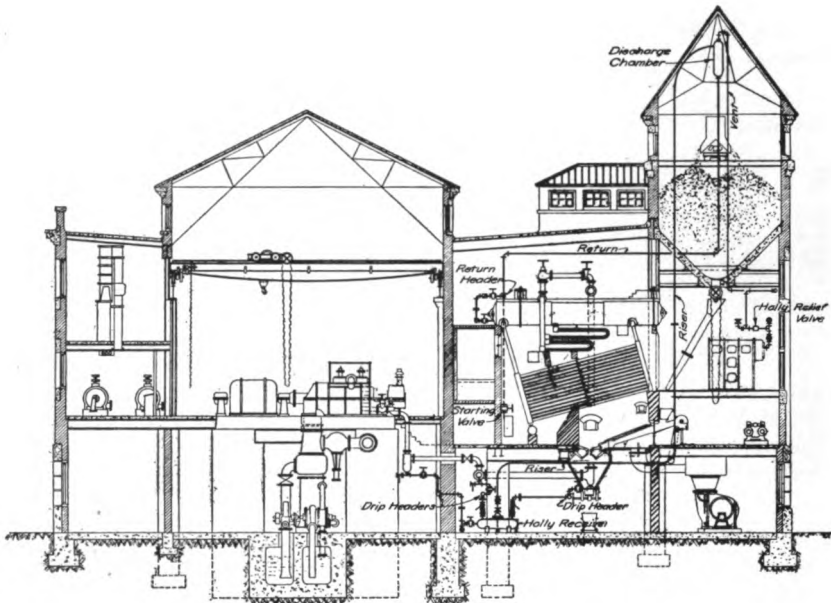
from ever being closed by scale, etc. Equipped with special slow opening driplless pet cock. Balls cannot seat unless glass is broken, because the upper ball seat is designed to leak, which is necessary to

the perfect operation of an automatic gauge, by preventing a false water level from being shown. Lugs are cast in the body to support ball in lower arm in case stem is removed. Has cap in top for replacing gauge glass.

---

**RUSSELL B. HOBSON .**  
NEW BRIGHTON, N. Y.

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Typical Elevation of Holly Gravity Return System

**THE HOLLY GRAVITY RETURN SYSTEM:**

To pump or trap condensation at 300° or 400° Fahrenheit and the corresponding pressures without waste of steam or labor of up-keep is just as difficult as ever, but perfectly easy with the modern Holly Gravity Return System. The old type system was designed to be half loaded with water. The new type is a dry pocket, pulling the condensation out of every part of the steam piping or apparatus and throwing it back into the boilers so rapidly that it enters almost at the full boiler temperature.

The Holly System never tires. It is the watch dog of the power plant, and whether there is little or much to do, it stands ready to perform at its full capacity of many thousand pounds per hour.

While we are equipping some of the very best type of new power plants we find a fruitful field in displacing the various devices which have failed, involving double expense.

Why not install the Holly System at first and prevent the possibility of leakage and of loss? Let us give you references and quote you,

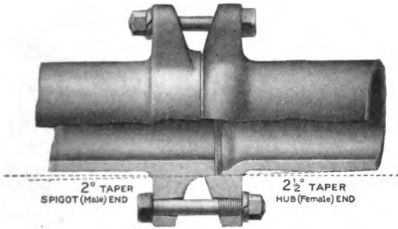
# THE CENTRAL FOUNDRY COMPANY

90 WEST STREET, NEW YORK

CHICAGO ATLANTA SAN FRANCISCO DALLAS KANSAS CITY, Mo.

Manufacturers of Universal Pipe, Soil Pipe, F. & W. Fittings, General Castings

## UNIVERSAL PIPE:



### PIPE AND JOINT ARE ONE

Universal Pipe is cast iron pipe with hub and spigot ends, the contact surfaces of which are machined on a taper giving a natural iron to iron joint, which is permanently tight. By making the tapers of slightly different pitch the joint provides for expansion and contraction, vibration and uneven ground settlement.

The lengths of pipe are drawn together by bolts, two bolts to a joint sufficing except for pressures above 175 pounds in some sizes. The pipe can therefore be laid at a slight labor cost, and without calking. No molten lead, oakum, etc., required. No equipment, except two wrenches.

The iron to iron contact of the Uni-

versal Joint eliminates electrolysis. The result is a pipe that does not leak and a joint that will remain tight under pressure even up to 300 pounds.

**High Pressure Service:** Universal Pipe is especially adapted to high pressure service, and particularly for high pressure fire lines. There is no packing to blow out, and nothing to deteriorate.

**Subaqueous Work:** Lines running under rivers or submerged work of any kind can be easily and economically constructed by the use of Universal Pipe.

No molten lead required, the pipe can be laid in wet trenches or in shallow water without special equipment.

**Gas Systems:** Universal Pipe is particularly advantageous in high or low pressure gas lines, by reason of the tight joint under differences of temperature and its freedom from electrolysis. The close contact of the smooth machined hub and spigot ends makes a joint through which gas cannot escape.

**Curved Lines:** Straight lengths of Universal Pipe may be laid on a curve of 100 feet radius.



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TRADE  
MARK

## SPECIFICATIONS

Nominal Inside Diameter	Class No. 100 100 Lbs. Pressure				Class No. 130 130 Lbs. Pressure				Class No. 175 175 Lbs. Pressure				Class No. 250 250 Lbs. Pressure				Bolt Sizes	
	Approx. Thickness Inches		Estimated Weight Pounds per		Approx. Thickness Inches		Estimated Weight Pounds per		Approx. Thickness Inches		Estimated Weight Pounds per		Approx. Thickness Inches		Estimated Weight Pounds per			
	Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	.37	18	108	.40	18 1/4	112 1/2	.43	20 1/4	121 1/2	.45	21 1/4	127 1/2	.48	22 1/2	133 1/2	5/8	1 1/4	
6	.43	30	180	.45	31	186	.47	32	192	.51	35 1/2	213	.53	36 1/2	225	3/4	1 1/2	
8	.47	44 1/4	265 1/2	.49	46	276	.525	49 1/4	295 1/2	.58	53 1/4	319 1/2	.60	55 1/4	339 1/2	7/8	1 3/4	
10	.50	60 1/2	363	.53	63 1/2	381	.58	67 3/4	406 1/2	.64	74	444	.67	77 1/2	471	1	2	
12	.53	75 1/2	453	.57	80 1/2	483	.62	87	522	.70	97 1/2	585	.73	102 1/2	639	1 1/8	2 1/4	
14	.565	94 1/2	567	.60	99 1/2	597	.66	107 1/2	645	.76	124	744	.79	129 1/2	801	1 1/2	2 3/4	
16	.60	115 1/2	693	.65	123	738	.72	134	804	.83	156	936	.86	161 1/2	1008	1 3/4	3	

Lengths lay a full six feet. All pipe tested with a minimum hydrostatic pressure of 300 pounds per square inch.

**Special Castings** are made with Universal hub and spigot openings, thus avoiding, except in extreme cases, the use of nipples. The lugs upon special castings are in one plane so that the branches or openings will all be in the same plane.

**Approved by Fire Underwriters:** Universal Pipe and Fittings have been tested and approved for fire protection service by the Underwriters' Laboratories which are under the direction of the National Board of Fire Underwriters.



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## A. M. BYERS COMPANY

PLANTS AND OFFICES, PITTSBURGH, PA.

NEW YORK

DISTRICT SALES OFFICES  
BOSTON CHICAGO  
Distributors In All Jobbing Centers

DALLAS

**Manufacturers of Byers Genuine Wrought Iron Pipe, Couplings and Nipples**

### GUARANTEE:

*All Byers Pipe is guaranteed to be made exclusively from Byers pig iron, which is refined by hand puddling, rolled into muck bar and finally converted into skelp without the use of scrap in any of the processes of manufacture.*

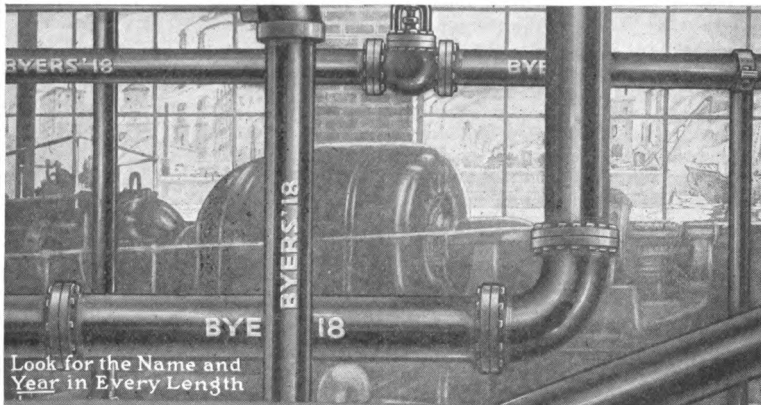
*Every individual length of Byers Pipe is guaranteed to have passed rigid inspection and testing, and to be full weight with a variation of not more than 2½ per cent below card weight.*

tion and physical stresses cause crystallization and premature failure of steel pipe.

### RESISTANCE TO CORROSION:

Probably no other single quality has contributed more to the reputation of Byers Pipe than its ability to withstand the attacks of corrosive agents. Byers Pipe has shown a life several times greater than steel in hot and cold water, steam, oil and air lines and in many other kinds of service in buildings, industrial plants, mines, smelters, and power

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**SIZES, WEIGHTS, ETC.:** Made in all sizes from ½" to 12" black and galvanized and in three weights: *Standard* for all purposes where conditions of corrosion are normal, *extra heavy* for use where corrosion is severe or where more physical strength is required than is possessed by standard weight pipe, and *double extra heavy* for use where conditions are extremely severe either from a corrosive or mechanical standpoint.

**USES:** For the conveyance of hot and cold water, steam, gases, air, oil, chemicals such as concentrated acids, salts in solution, solvents, etc. Byers can be used advantageously wherever welded ferrous pipe can be used, especially where corrosion is an important factor in determining the life of the pipe and where vibra-

plants. Detailed records of the comparative service given by Byers and steel pipe will be sent on request.

### ADVANTAGES SUMMARIZED:

Great resistance to corrosion due to inclusion of finely divided, non-corrosive slag filaments.

Resistance to crystallization and fracture under the influence of vibration and physical stresses, due to the fibrous structure.

Easily threaded, cut and bent; perfect threads insure permanently tight joints.

Uniformly strong welds (shown by test to be as strong as the body of the pipe).

# A. M. BYERS COMPANY



Look for the name and year rolled in every length

Permissible variation in weight is 2½ per cent. below and 5 per cent. above weights given in tables.

Standard weight pipe is regularly furnished with threads and couplings and in random lengths, unless otherwise ordered.

## Hydrostatic Test:

⅜" ..... 250 lbs.  
 ¾" to 1½" B. W ..... 750 lbs.  
 1¼" to 9" L. W. and  
 10" (40.483 lbs.) ..... 1000 lbs.  
 Other 10", 11" and 12" ..... 750 lbs.

## WEIGHTS, SIZES, DIMENSIONS OF STANDARD PIPE

Size	List Price per Foot	DIAMETER		WEIGHT PER FOOT Plain Ends	Threads per Inch	COUPLINGS		
		External	Internal			Outside Diam. Inches	Length Inches	Weight Pounds
BUTT WELD	1½	.05½	.405	.244	27	.640	.937	.053
	1¼	.06	.540	.424	18	.750	1.000	.059
	3¼	.06	.675	.567	18	.968	1.343	.156
	1½	.08½	.840	.617	14	1.078	1.343	.168
	¾	.11½	1.050	.819	14	1.312	1.531	.243
	1	.17	1.315	1.043	11½	1.656	1.718	.425
	1¼	.23	1.660	1.369	11½	1.984	2.062	.631
	1½	.27½	1.900	1.604	11½	2.281	2.312	.884
	1¼	.23	1.660	1.369	11½	1.984	2.062	.631
	1½	.27½	1.900	1.604	11½	2.281	2.312	.884
LAP WELD	2	.37	2.375	2.060	11½	2.750	2.500	1.100
	2½	.58½	2.875	2.460	8	3.312	3.125	2.100
	3	.76½	3.500	3.059	8	4.031	3.125	3.025
	3½	.92	4.000	3.538	8	4.500	3.687	3.900
	4	1.09	4.500	4.016	8	4.968	3.687	4.200
	4½	1.27	5.000	4.496	8	5.531	4.218	6.200
	5	1.48	5.563	5.036	8	6.281	4.125	8.250
	6	1.92	6.625	6.053	8	7.375	4.156	10.800
	7	2.38	7.625	7.010	8	8.375	5.000	14.650
	8	2.50	8.625	8.059	8	9.406	5.000	16.250
	8	2.88	8.625	7.967	8	9.406	5.000	16.250
	9	3.45	9.625	8.927	8	10.687	6.375	33.700
	10	3.20	10.750	10.181	8	11.937	6.750	42.200
	10	3.50	10.750	10.124	8	11.937	6.750	42.200
	10	4.12	10.750	10.005	8	11.937	6.750	42.200
	11	4.63	11.750	10.985	8	12.937	6.750	45.900
	12	4.50	12.750	12.077	8	13.875	6.937	49.100
	12	5.07	12.750	11.985	8	13.875	6.937	49.100

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Complete tables covering all sizes of Extra Heavy and Double Extra Heavy Pipe furnished on request.



# JAMES B. CLOW AND SONS

Established 1878

CHICAGO, ILL.

NEW YORK

PITTSBURGH

MILWAUKEE

DETROIT  
SAN FRANCISCO

MINNEAPOLIS

PHILADELPHIA

ST. LOUIS

Manufacturers of Cast Iron Pipe, Plumbing and Heating Supplies

## PIPE:



### Steel or Wrought Iron Threaded:

We can furnish random lengths of steel or wrought iron pipe in all standard sizes either black or galvanized. Cut lengths to order.



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### Cast Iron Hub and Spigot:

Carried in stock in sizes from 3 to 48 inches. 12-foot lengths are regular—shorter lengths will be cut to order. This pipe is made in all classes for all pressures.



### Cast Iron Flanged:

Made in all sizes from 1 1/4 to 48 inches and in all classes for all pressures. 12-foot lengths are regular—shorter lengths will be cut to order.



### Cast Iron Threaded:

This pipe is made in all sizes from 1 1/4 to 16 inches, inclusive. It is threaded at both ends the same as steel or wrought iron pipe. 12-foot lengths are regular.

## FITTINGS:



### Cast Iron or Malleable Screwed:

We carry a very large stock of screwed fittings in both cast iron and malleable iron, black or galvanized straight and reducing.



### Cast Iron Hub and Spigot:

Water and gas fittings are carried in stock in all sizes from 3 to 48 inches, in straight and reducing sizes. We also have cutting-in specials of all kinds.



### Cast Iron Flanged:

We carry a very large stock of flanged cast iron fittings in all standard sizes for low, standard and extra heavy pressures, both straight and reducing.



### Cast Iron Threaded:

We make a complete line of cast iron threaded fittings for use with our threaded cast iron pipe. In both straight and reducing sizes.

**All Pipe and Fittings Carried in Stock for All Pressures.**

**Castings for Special Purposes Made to Order.**

## JAMES B. CLOW AND SONS



Showroom, Chicago

In our CHICAGO BUILDING we carry a complete stock of the following material:

Plumbing Supplies, including Drinking Fountains, Automatic Water Closets, Lavatories, Sinks, etc.

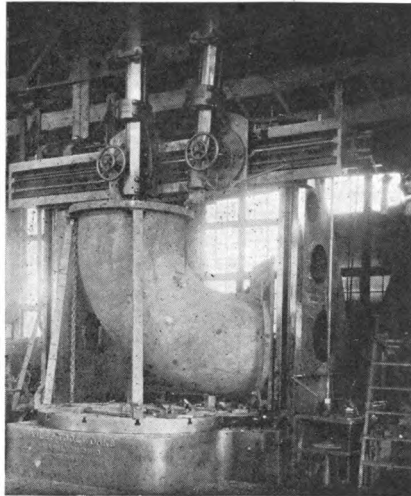
Steam Supplies including Steel and Wrought Iron Pipe, Cast Iron and Malleable Fittings, Low, Standard and Extra Heavy Valves with Screwed—Flanged—Hub and Spigot Connections—Straightway—Angle—Check—Flap, etc.

Water Works Supplies including Cast Iron Bell and Spigot—Flanged and Threaded Pipe and Fittings—Lead—Oakum—Tools, etc.

We also manufacture in Chicago the Ultra Violet Ray Water Sterilizers, Marble Products for all purposes and all Brass work for our plumbing business including Faucets, Bibbs, Traps, Supplies, Showers, etc.



Square Manhole Frame and Cover



Facing 48-inch Elbow

At our Ohio Plants, which specialize on making Cast Iron Pipe and Fittings, a complete line of Cast Iron Specialties is also produced. These include the following: Manholes—Lamp Posts—Fountains—Special Castings for Coke Ovens—Filtration Plants—Sugar Refineries—Chemical Companies—Oil Refineries, etc.—Radiators—Boilers—Plumbing Specialties such as Bell Traps—Drum Traps—Gratings, etc. 189

### CATALOGUES:

Complete Catalogues will be gladly sent to you describing that in which you are interested.

**Plumbing—Catalogue "M."**

**Drinking Fountains—Fountain Catalogue.**

**Heating—Special Catalogue.**

**Cast Iron Pipe, Fittings and Foundry Products—Pipe Economy.**

**Steam and Water Work Supplies—Catalogue "A."**

**Water Sterilization—R. U. V. Catalogue.**

# LYNCHBURG FOUNDRY COMPANY

LYNCHBURG, VIRGINIA

MAIN OFFICE  
LYNCHBURG, VA.

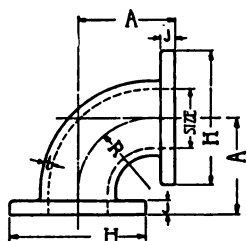
WESTERN SALES OFFICE  
1212 PEOPLE'S GAS BUILDING  
CHICAGO, ILLINOIS

EXPORT OFFICE  
95 LIBERTY ST., N. Y.

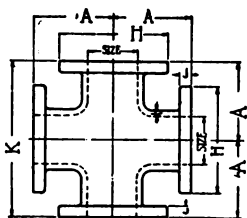
WORKS—LYNCHBURG, VA.—RADFORD, VA.—ANNISTON, ALA.

Manufacturers of Cast Iron, Bell and Spigot Pipe and Fittings  
Cast Iron Flanged Pipe and Fittings; Municipal Castings of Every Description  
General Founders and Machinists

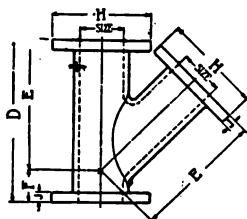
## AMERICAN STANDARD CAST IRON FLANGED PIPE AND FITTINGS:



Standard Ells



Standard Crosses



Standard Laterals

Letters refer to dimensions given under respective headings in the table in adjoining column.

## TABLE OF DIMENSIONS

Standard 125 lbs. Pressure

SIZE	A	D	E	F	H	J	K	R	t
1	3 1/2	7	5 3/4	1 3/4	4	1 1/2	7	2 3/4	1 1/8
1 1/4	3 3/4	8	6 1/4	1 3/4	4 1/2	1 1/2	7 1/2	3	1 1/8
1 1/2	4	9	7	2	5	1 1/2	8	3 1/4	1 1/8
2	4 1/2	10 1/2	8	2 1/2	6	1 1/2	9	3 1/2	1 1/8
2 1/2	5	12	9 1/2	2 1/2	7	1 1/2	10	4	1 1/8
3	5 1/2	13	10	3	7 1/2	1 1/2	11	4 1/2	1 1/8
3 1/2	6	14 1/2	11 1/2	3	8 1/2	1 1/2	12	5	1 1/8
4	6 1/2	15	12	3	9	1 1/2	13	5 1/2	1 1/8
4 1/2	7	15 1/2	12 1/2	3	9 1/4	1 1/2	14	5 3/4	1 1/8
5	7 1/2	17	13 1/2	3 1/2	10	1 1/2	15	6 1/4	1 1/8
6	8	18	14 1/2	3 1/2	11	1 1/2	16	6 3/4	1 1/8
7	8 1/2	20 1/2	16 1/2	4	12 1/2	1 1/2	17	7 1/4	1 1/8
8	9	22	17 1/2	4 1/2	13 1/2	1 1/2	18	7 3/4	1 1/8
9	10	24	19 1/2	4 1/2	15	1 1/2	20	8 3/4	1 1/8
10	11	25 1/2	20 1/2	5	16	1 1/2	22	9 3/4	1 1/8
12	12	30	24 1/2	5 1/2	19	1 1/2	24	10 3/4	1 1/8
14	14	33	27	6	21	1 1/2	28	12 3/4	1 1/8
15	14 1/2	34 1/2	28 1/2	6	22 1/4	1 1/2	29	12 3/4	1 1/8
16	15	36 1/2	30	6 1/2	23 1/2	1 1/2	30	13 3/4	1 1/8
18	16 1/2	39	32	7	25	1 1/2	33	14 3/4	1 1/8
20	18	43	35	8	27 1/2	1 1/2	36	16 1/8	1 1/8
22	20	46	37 1/2	8 1/2	29 1/2	1 1/2	40	17 1/4	1 1/8
24	22	49 1/2	40 1/2	9	32	1 1/2	44	19 1/2	1 1/4

Standard fittings guaranteed for 125 lbs. working pressure.

Extra heavy fittings guaranteed for 250 lbs. working pressure.

## AMERICAN WATER WORKS ASSOCIATION CAST IRON BELL AND SPIGOT PIPE AND FITTINGS:

Catalogs mailed upon request.



# UNITED STATES CAST IRON PIPE & FOUNDRY COMPANY

GENERAL OFFICE: BURLINGTON, NEW JERSEY

**Manufacturers of Cast Iron Pipe—Bell and Spigot, Flange, Flexible Joint, High Pressure Fire Protection Lines, Plain End and Threaded. Fittings—Bell and Spigot Flange, Steam—Semi-Steel and Cast Iron, Standard and Special. Columns—Cast Iron Building. Culverts—Cast Iron. Castings—Chemical and Gray Iron, Semi-Steel, Hydraulic, Etc., 1 Lb. to 50 Tons**

## SALES OFFICES

Philadelphia, 1421 Chestnut St. Pittsburgh, Henry W. Oliver Bldg. Buffalo, 957 E. Ferry St.  
Chicago, 122 So. Michigan Blvd. St. Louis, Security Bldg. Cleveland, 1150 E. 26th St.  
San Francisco, Monadnock Bldg. New York, 71 Broadway. Minneapolis, Plymouth Bldg.  
Birmingham, Ala., Am. Trust Bldg.

## WORKS

ADDYSTON, OHIO  
ANNISTON, ALA.  
BESSEMER, ALA.

BIRMINGHAM, ALA.  
BURLINGTON, N. J.  
CHATTANOOGA, TENN.

CLEVELAND, OHIO  
COLUMBUS, OHIO  
SCOTTDALE, PA.

**U. S. CAST IRON PIPE**—In all sizes from 2 inch to 84 inch diameter—is cast vertically in dry sand molds thereby insuring a uniform wall thickness. All types for water, gas sewers, drains, culverts, oil, high pressure fire service, power and industrial plant piping and submerged lines.

**FITTINGS**—Standard and Special, Bell and Spigot to American Water Works Standard. Flanged to American Standard 1914, American Water Works Standard, and American Gas Institute Standard. Hydraulic, Drainage, Steam Fittings, semi-steel and cast iron.

**CAST IRON COLUMNS**—"Keystone" Building.

**CULVERTS**—Cast iron, in 4 ft., 6 ft., 8 ft., 12 ft. lengths and Crown lengths in five weights—Light, Medium, Standard, Heavy and Extra Heavy.

**GENERAL CASTINGS**—1 lb. to 50 tons, in the rough or machined. Hydraulic Cylinders, Presses, Accumulators, Castings for Machine Tool Builders, Semi-Steel, Chemical, Sugar House, etc.

## STANDARD THICKNESSES AND WEIGHT OF CAST IRON PIPE

As made by United States Cast Iron Pipe & Foundry Co. and adopted May 12th, 1908, by American Water Works Association

Nominal Inside Diam. Inches	CLASS A 100 FT. HEAD 43 LBS. PRESSURE			CLASS B 200 FT. HEAD 86 LBS. PRESSURE			CLASS C 300 FT. HEAD 130 LBS. PRESSURE			CLASS D 400 FT. HEAD 173 LBS. PRESSURE			Ap'r'x-imate lbs. Lead p'r'J'nt 2 in. Thick	Ap'r'x-imate lbs. Hump per Joint
	Thick- ness Inches	Weight per		T'h'- ness In.	Weight per		Thi'h'- ness Inch's	Weight per		Thi'h'- ness Inches	Weight per			
		Foot	L'gth		Foot	L'gth		Foot	L'gth		Foot	L'gth		
3	.39	14.5	175	.42	16.2	194	.45	17.1	205	.48	18.0	216	6.00	.18
4	.42	20.0	240	.45	21.7	260	.48	23.3	280	.52	25.0	300	7.50	.21
6	.44	30.8	370	.48	33.3	400	.51	35.8	430	.55	38.3	460	10.25	.31
8	.46	42.9	515	.51	47.5	570	.56	52.1	625	.60	55.8	670	13.25	.44
10	.50	57.1	685	.57	63.8	765	.62	70.8	850	.68	76.7	920	16.00	.53
12	.54	72.5	870	.62	82.1	985	.68	91.7	1100	.75	100.0	1200	19.00	.61
14	.57	89.6	1075	.66	102.5	1230	.74	116.7	1400	.82	129.2	1550	22.00	.81
16	.60	108.3	1300	.70	125.0	1500	.80	143.8	1725	.89	158.3	1900	30.00	.94
18	.64	129.2	1550	.75	150.0	1800	.87	175.0	2100	.96	191.7	2300	33.80	1.00
20	.67	150.0	1800	.80	175.0	2100	.92	208.3	2500	1.03	229.2	2750	37.00	1.25
24	.76	204.2	2450	.89	233.3	2800	1.04	279.2	3350	1.16	306.7	3680	44.00	1.50
30	.88	291.7	3500	1.03	333.3	4000	1.20	400.0	4800	1.37	450.0	5400	54.25	2.06
36	.99	391.7	4700	1.15	454.2	5450	1.36	545.8	6550	1.58	625.0	7500	64.75	3.00
42	1.10	512.5	6150	1.28	591.7	7100	1.54	716.7	8600	1.78	825.0	9900	75.25	3.62
48	1.26	666.7	8000	1.42	750.0	9000	1.71	908.3	10900	1.96	1050.0	12600	85.50	4.37
54	1.35	800.0	9600	1.55	933.3	11200	1.90	1141.7	13700	2.23	1341.7	16100	97.60	6.25
60	1.39	916.7	11000	1.67	1104.2	13250	2.00	1341.7	16100	2.38	1533.3	19000	108.30	8.25
72	1.62	1283.4	15400	1.95	1545.8	18550	2.39	1904.2	22850	.....	.....	.....	128.00	12.50
84	1.72	1633.4	19600	2.22	2104.2	25250	.....	.....	.....	.....	.....	.....	147.00	15.00

The above weights are per length to lay 12 feet, including standard sockets; proportionate allowance to be made for any variation.

## **MALLEABLE IRON FITTINGS CO.**

INCORPORATED 1864

BRANFORD, CONN.

**Manufacturers of Malleable Iron Pipe Fittings for Gas, Steam and Water; Steel Fittings for High Pressure Service; Air Furnace Refined Malleable Iron and Semi-Steel Castings; Carbon and Alloy Steel Castings; Foundry Vibrators; Boat Hardware; Clamps; Oilers; and Hardware Specialties**

### **EXTRA HEAVY FLANGES:**

**For High Pressure Requirements**

For Rolled, Shrunk or Welded Connection, bored, countersunk, grooved, faced and drilled to specification.

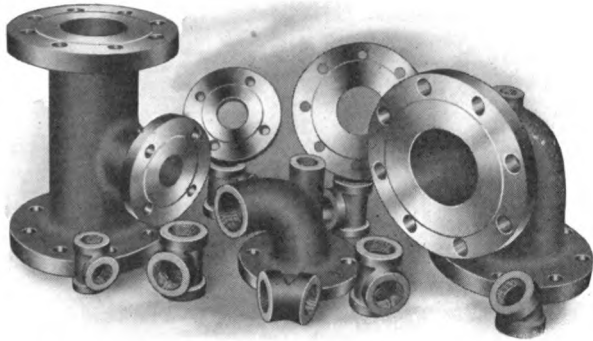
### **LOW CARBON STEEL CASTINGS:**

Equal to Crucible Steel Castings.

### **SPECIAL METAL "A":**

For Gears and Cams where resistance to wear is wanted. May be heat-treated to required hardness.

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### **HIGH PRESSURE FITTINGS:**

**Standard Sizes in Stock in Steel or Malleable**

Machined, tested and ready for the line. Specials made to order for railroad, manufacturing, mining, and municipal power plants in compliance with Lloyds Rules or Regulations of the U. S. Steamboat Inspection Service.

### **MALLEABLE IRON AND SEMI-STEEL CASTINGS:**

For Machinery; Automobile; Gun; Sewing-Machine; Overhead, Third-Rail, underground Electrical Construction and all miscellaneous work.

### **AIR FURNACE REFINED VANADIUM IRON:**

For Piston Heads, Piston Rings, and Cylinders. Has a high tensile strength and is tough, sound, and dense. Especially adapted for Forging Dies and Heavy Service Gears.

### **CUSTOM AND JOBBING DEPARTMENT:**

Galvanizing, Tinning, Japanning, Contract Machining of Malleable Iron, Grey Iron, Wrought Iron, and Steel. Galvanized Nails—Marine Hardware.

# PENNSYLVANIA FORGE CO.

OFFICE AND WORKS: BRIDESTOWN, PHILADELPHIA, PA.

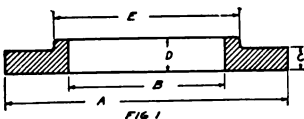
Manufacturers of Steel, Bronze and Monel Forgings

## FORGED STEEL FLANGES:

Dimensions shown below have been recommended as standard by the A. S. M. E.

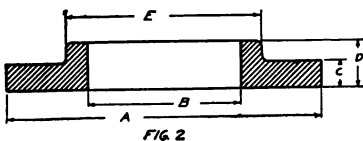
Flanges are smooth forged to the given sizes, except additional material is allowed on the face for finishing. Any dimension may be increased as desired.

Standard Low Hub  
For Screwed or Rolled Joints



Nominal Size Inches	Outside Diam. A	Diam. Bore B	Th'k-ness C	De'th of Hub D	Diam. of Hub E	W'gt Lbs.
2	6	2 1/8	3/8	1	3 1/8	7
2 1/2	7	2 1/2	3/8	1 1/8	3 3/8	9
3	7 1/2	3 1/8	3/8	1 1/8	4 1/8	10
3 1/2	8 1/2	3 3/8	3/8	1 1/8	4 3/8	14
4	9	4 1/8	3/8	1 1/8	5 3/8	16
4 1/2	9 1/4	4 3/8	3/8	1 1/8	5 1/2	17
5	10	5 1/8	3/8	1 1/8	6 1/8	19
6	11	6 1/8	1	1 1/8	7 1/8	23
7	12 1/2	7 1/8	1 1/8	1 1/2	8 5/8	31
8	13 1/2	8 3/8	1 1/8	1 5/8	9 1/2	36
9	15	9 3/8	1 1/8	1 3/4	10 5/8	44
10	16	10 3/8	1 1/8	1 7/8	11 1/2	51
12	19	12 3/8	1 1/8	2 1/8	14 1/8	74
14	21	13 3/8	1 1/8	2 3/8	15 1/8	96

Extra Heavy Low Hub  
For Screwed or Rolled Joints



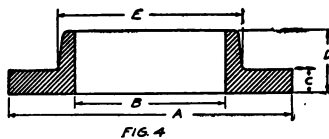
Nominal Size Inches	Outside Diam. A	Diam. Bore B	Th'k-ness C	De'th of Hub D	Diam. of Hub E	W'gt Lbs.
2	6 1/2	2 1/8	7/8	1 3/8	3 3/8	10
2 1/2	7 1/2	2 1/2	1	1 1/8	4 1/8	14
3	8 1/2	3 1/8	1	1 1/8	4 1/8	17
3 1/2	9	3 3/8	1 1/8	1 3/8	5 1/8	21
4	10	4 1/8	1 1/8	1 3/8	5 1/8	28
4 1/2	10 1/2	4 3/8	1 1/4	1 1/2	6 1/4	31
5	11	5 1/8	1 1/4	1 1/2	6 1/4	33
6	12 1/2	6 1/8	1 1/4	2	7 1/8	43
7	14	7 1/8	1 1/2	2 1/8	9 1/8	54
8	15	8 3/8	1 1/2	2 1/8	10 1/8	62
9	16 1/4	9 3/8	1 1/2	2 1/4	11 1/8	73
10	17 1/2	10 3/8	1 1/2	2 3/8	12 1/8	83
12	20 1/2	12 3/8	1 1/2	2 3/8	14 1/8	123
14	23	13 3/8	1 1/2	2 1/2	15 1/8	160
15	24 1/2	14 1/2	1 1/2	2 1/2	17 1/8	190
16	25 1/2	15 1/2	1 1/2	3 1/8	18 1/4	210

Standard High Hub  
For Shrunk or Peened Joints



Nominal Size Inches	Outside Diam. A	Diam. Bore B	Th'k-ness C	De'th of Hub D	Diam. of Hub E	W'gt Lbs.
4	9	4 3/8	1 1/8	2 3/16	5 3/4	20
4 1/2	9 1/4	4 7/8	1 1/8	2 1/4	6 1/8	21
5	10	5 1/8	1 1/8	2 1/8	6 3/8	23
6	11	6 1/2	1	2 1/8	7 3/8	27
7	12 1/2	7 1/2	1 1/8	2 1/2	9	34
8	13 1/2	8 1/2	1 1/8	2 3/8	10	40
9	15	9 1/2	1 1/8	2 3/4	11 1/8	48
10	16	10 3/8	1 1/8	3	12 1/4	56
12	19	12 3/8	1 1/4	3 3/8	14 1/2	88
14	21	13 3/8	1 3/8	3 3/8	15 1/8	110
15	22 1/4	14 1/8	1 3/8	3 1/2	16 3/8	122
16	23 1/2	15 1/8	1 1/2	3 3/8	18	140

Extra Heavy High Hub  
For Van Stone, Single Riveted, Shrunk or Peened Joints



Nominal Size Inches	Outside Diam. A	Diam. Bore B	Th'k-ness C	De'th of Hub D	Diam. of Hub E	W'gt Lbs.
4	10	4 3/8	1 1/8	3 1/8	5 3/4	28
4 1/2	10 1/2	4 7/8	1 1/4	3 1/4	6 1/4	34
5	11	5 1/8	1 1/4	3 1/4	7 1/8	37
6	12 1/2	6 1/2	1 1/4	3 1/4	7 1/8	45
7	14	7 1/2	1 1/2	3 3/8	9 1/8	55
8	15	8 1/2	1 1/2	3 1/2	10 1/8	62
9	16 1/4	9 3/8	1 1/2	3 3/8	11 1/8	74
10	17 1/2	10 3/8	1 1/2	3 3/4	12 1/8	90
11	18 3/4	11 3/8	1 1/2	3 3/8	13 1/8	112
12	20 1/2	12 3/8	1 1/2	4	14 1/4	131
14	23	13 3/8	1 1/2	4 3/8	16 1/8	182
15	24 1/2	14 1/8	1 1/2	4 1/2	17 1/4	196
16	25 1/2	15 1/8	1 1/2	4 3/4	18 1/2	223
18	28	17 3/8	2	5	20 1/4	259

Flanges of other dimensions furnished on specification.

We are prepared to furnish flanges completely machined, including facing, drilling and threading.

Also Connecting Rods, Piston Rods, Crank Shafts, Rolls, Die Blocks, Hammered Bars, Weldless Rings, Spindles, Etc.

## E. B. BADGER & SONS COMPANY

75 PIRTS Sr.  
BOSTON, MASS.

101 PARK AVENUE  
NEW YORK, N. Y.

Manufacturers of Badger Equalizing Expansion Joints for High and Low Pressure

### BADGER SELF-EQUALIZING EXPANSION JOINTS:

Are one-piece Joints made from Seamless Copper Tube, with deep corrugations properly designed and rolled to stand the repeated changes in shape due to temperature changes in pipe line.

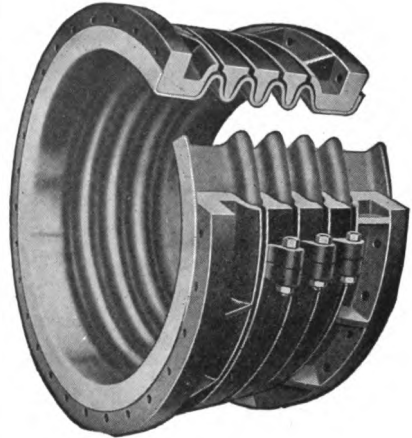
The expansion is controlled in the Joints by Equalizing Rings fitted to the corrugations, which equally distribute the expansion over each corrugation, thus eliminating the possibility of fracture in the copper, due to having one corrugation take up all of the traverse.

Once they are installed with the necessary anchors and guides, they require no further attention as they are one-piece Joints and never require packing.

They are installed in a pipe line as easily as any flanged fitting.

They are made for high and low pressure, each Joint being subjected to a hydraulic test before shipment.

Badger Self-equalizing Expansion Joints installed in your pipe lines will eliminate all future expansion troubles, and give you the maximum service at the least cost.



Face to Face Dimensions

Size	Two corrugations	Three corrugations	Four corrugations
6"	12 1/2"	16"	19"
8"	12 1/2"	16"	19"
10"	12 1/2"	16"	19"
12"	13"	16 1/2"	20"
14"	13 1/2"	17"	20"
16"	13 1/2"	17"	20"
18"	14"	17 1/2"	21"
20"	15"	18 1/2"	21 1/2"
22"	15"	18 1/2"	21 1/2"
24"	15 1/2"	19"	22"

### BADGER EQUALIZING EXPANSION JOINTS are made

two corrugations to care for 1" expansion

three corrugations to care for 1 1/2" expansion

four corrugations to care for 2" expansion.

We are also manufacturers of the Badger Single-corrugation Expansion Joint for connection between turbines and condensers, and designed for any special requirements.

Write for our catalog No. 12.



# BARCO MANUFACTURING CO.

212-220 WEST ILLINOIS ST.,

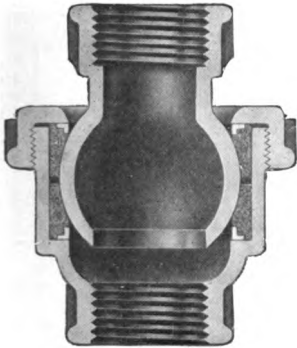
CHICAGO, ILLINOIS

Manufacturers of Barco Flexible Joints and Crossheads and Crosshead Shoes

## BARCO FLEXIBLE JOINTS:

These joints have now been on the market over twelve years, and are well known to engineers and users of flexible joints everywhere for their efficiency and durability.

We recommend them very strongly wherever a flexible connection is required for steam, air,



Pat. 1-6-03

oils, gases and water, either under pressure or suction.

Barco Flexible Joints consist of three metallic parts and two non-metallic gaskets which surround the ball and prevent it from coming in contact with the other metallic parts, *i. e.*, the cap and casing. The gaskets offer a firm resisting



Straight Joint



Angle Joint

seat somewhat softer than the ball, but hard enough to keep perfect shape without disintegration. The fact that the gaskets are softer than the ball and conform to its surface accounts for the absolute tightness of the joints under all conditions, and the self-lubricating feature of the gaskets insures free, easy movement with minimum wear. They are interchangeable, or renewable at small cost, making the joint practically new. The gaskets are very durable and will last a long time.

In steel mills for water cooled doors and tracks. On pile drivers.

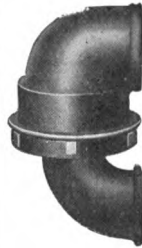
Around coke ovens to replace rubber hose.

Laying pipe lines on pontoon or temporary bridges.

Expansion joints on pipe lines—large or small. On sprinkler cars for electric railroads.

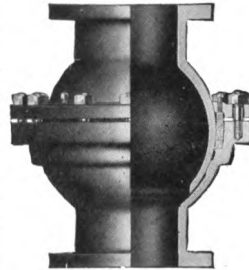
Loading and unloading oil lighters and barges. Steam heating oil lighters and barges.

For vulcanizing presses.

Angle Joint  
Angle Both EndsHexagon Male End  
Joint

Barco Flexible Joints are made in any metal or materials in common use, but are regularly furnished in bronze and malleable iron in the screw ends, and cast iron in the flange ends. The bronze joints are recommended for the best service. Barco Malleable Iron Joints combine the greatest strength with the least weight. The metal and finish are the very finest, and the joints are treated by a process which makes them practically rustproof.

All joints are tested under steam pressure, or air pressure.



Pat. Oct. 6, 1908

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## SOME OF THE USES OF BARCO FLEXIBLE JOINTS ARE:

On steam shovels and dredges, and sand suckers.

Movable pipe lines in mines and quarries for rock drill and channeling machines.

Blowing off locomotives in railroad round-houses.

Blower pipe arrangements in railroad round-houses.

Connection between engine and tender for steam, air, crude oil and feed water.

Testing blocks of engine, pump and boiler manufacturers.

Steamships and engine rooms to take up expansion or vibration in steam pipe lines.

For pneumatic hoists and traveling cranes.

On steam brick presses.

In connection with steam irons.

On Lidgerwood unloaders.

Connection to rapid unloaders.

Laying pipe lines across rivers.

To replace rubber hose in cleaning boiler flues.

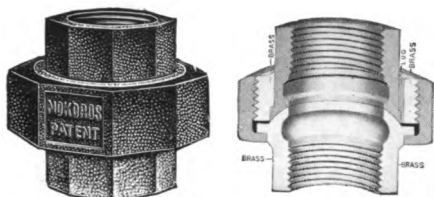
Steam syphons and piping service generally in mines.

Replacing rubber hose for heating cars at railroad terminals.

Connection to compressed air locomotives.

# ILLINOIS MALLEABLE IRON CO.

1801-25 DIVERSEY PARKWAY, CHICAGO, ILL.



## NOKOROS UNION (PATENTED):

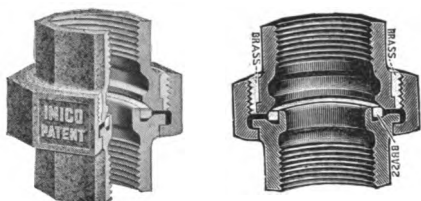
The only union made absolutely non-corrosive at all contact points.

Non-corrosive brass to iron thread connection.

Non-corrosive brass to iron seat between ring and tail-piece.

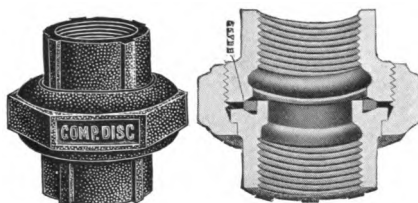
Octagon shape, a monkey wrench will turn.

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## IMICO UNION (PATENTED):

New Imico unions are made of malleable iron, extra heavy, with bronze metal valve seat disc and non-corrosive ring connection.



## C. D. RAILROAD UNION (PATENTED):

Heavy pattern malleable iron with brass valve seated disc. The face of each threaded section is beveled to receive a brass disc, and the connecting up of the union COMPRESSES the brass disc against the recesses, making a permanent steam metal seat.

## NOKOROS UNION PRICE LIST

Size Inches	PRICE	
	Plain, each	Galvanized, each
1/8	.30	.45
1/4	.30	.45
3/8	.40	.60
1/2	.50	.75
3/4	.60	.90
1	.80	1.20
1 1/4	1.20	1.80
1 1/2	1.60	2.40
2	2.00	3.00
2 1/2	3.20	4.80
3	4.80	6.50

## IMICO UNION PRICE LIST

Size Inches	PRICE	
	Plain, each	Galvanized, each
1/4	.30	.45
3/8	.40	.60
1/2	.50	.75
3/4	.60	.90
1	.80	1.20
1 1/4	1.20	1.80
1 1/2	1.60	2.40
2	2.00	3.00

## C. D. RAILROAD UNION PRICE LIST

Size Inches	PRICE	
	Plain, each	Galvanized, each
1/4	.30	.45
3/8	.40	.60
1/2	.50	.75
3/4	.60	.90
1	.80	1.20
1 1/4	1.20	1.80
1 1/2	1.60	2.40
2	2.00	3.00
2 1/2	3.20	4.80
3	4.80	6.20

Also manufacturers of malleable and cast iron fitting.

Write for catalogue.

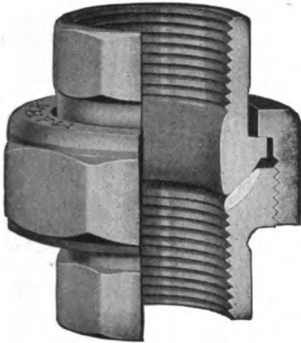
# MARK MANUFACTURING CO.

P. O. Box G, CHICAGO, ILL.

Makers of Wrought Pipe and Couplings, Boiler Tubes, Electric Wire Conduit, Well Casing, Well Points, Pump and Well Cylinders, Well Strainers, Well Valves and Tools, Pipe Cutters, Vises, Threading Dies, and Pump and Well Supplies

## THE MARK COLD DRAWN STEEL PIPE UNION:

Leakless—Rustless—Different



Cold drawn from rolled steel, the logical material for fittings used on steel pipe.

It will not leak, break or corrode—

### BECAUSE:

1. It will expand and contract in *exactly the same degree* as steel pipe with which it is used, consequently it is not subject to leakage at threads, which is unavoidable where malleable and brass unions are used with steel pipe.

2. It is entirely free from blow holes and sand holes, defects common to all types of unions made of malleable iron and cast brass.

3. It has a steel-to-brass seat, the brass ring being actually welded to the steel in which it is embedded.

4. The threads are accurately cut, and have the same taper as the pipe.

5. It is designed to carry high pressure as well as low, and all sizes are equally strong. 197

6. All surfaces, including all the threads, are rust-proofed. Therefore, the Mark Union will not rust or freeze to the pipe.

### SIZES AND LIST PRICES

Pipe Size	List Price
$\frac{1}{8}$ "	\$0.30
$\frac{1}{4}$ "	0.30
$\frac{3}{8}$ "	0.40
$\frac{1}{2}$ "	0.50
$\frac{3}{4}$ "	0.60
1"	0.80
$1\frac{1}{4}$ "	1.20
$1\frac{1}{2}$ "	1.60
2"	2.00
$2\frac{1}{2}$ "	3.20

## MAGNESIA ASSOCIATION OF AMERICA

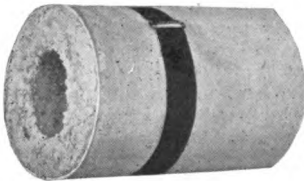
721 BULLETIN BUILDING, PHILADELPHIA, PA.

### Executive Committee of the Association

	WILLIAM A. MACAN, <i>Chairman</i>	
GEORGE D. CRABBS	The Philip Carey Co.	Cincinnati, Ohio
ALVIN M. EHRET	Ehret Magnesia Mfg. Co.	Valley Forge, Penna.
J. R. SWIFT	The Franklin Mfg. Co.	Franklin, Penna.
R. V. MATTISON, JR.	Keasbey & Mattison Co.	Ambler, Penna.

### "85% MAGNESIA" INSULATIONS:

#### For Pipes and Boilers



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Since 1888 "85% Magnesia" has been the standard specification of the U. S. Navy for heat-insulating coverings for steam pipes and boilers.

It is also the most generally used insulation for high pressure and superheated steam in the largest power plants of America.

"85% Magnesia" is also almost universally used for the lagging of high-powered locomotive boilers and for all services where exceptional service is demanded.

Its high insulation value is derived from the extremely large percentage of dead air held enmeshed in its structure, resulting in a heat-saving efficiency of from 85% to 95% (as compared with bare pipe) according to the steam pres-

sure and the thickness of the covering used.

Modern steam practice demands the use of a non-organic insulation in order to resist the tendency to carbonization and consequent loss of efficiency. "85% Magnesia" has a purely mineral origin and has been proved to retain its efficiency unimpaired over periods varying from 15 to 25 years.

"85% Magnesia" Coverings have exceptional powers of durability and of resistance to steam or water leakage while even actual immersion will not harm them. When the American Liner S. S. "St. Paul" was raised recently after four months' submergence at the bottom of the Hudson River, her "85% Magnesia" coverings, installed many years previously, were found unharmed. Many other similar instances of long service and immunity to exceptionally hard usage could be quoted.





# MAGNESIA ASSOCIATION OF AMERICA

## PROPER THICKNESS OF 85% MAGNESIA FOR MAXIMUM NET SAVING:

(Abbreviated from the Magnesia Association Specification.)

The thicknesses given in these tables and curves are based on a period of service of 8,760 hours per year. Twenty per cent. of the list cost has been allowed as the cost of application, and 13% of the total cost for the annual fixed charges (6% interest, 5% depreciation, 2% miscellaneous). The value of the heat-losses used in calculating the net savings is based on a series of experiments, covering a period of two years, made for the Magnesia Association by the Mellon Institute of Industrial Research of the University of Pittsburgh.

The tables below are based on average conditions. In transforming the steam-cost to coal-cost, it has been assumed that 75% of the cost of steam is coal-cost, that one pound of coal will evaporate seven pounds of water, and that each pound of steam contains 1,000 B. T. U. above the feed-water temperature.

COAL AT \$4.00 PER TON

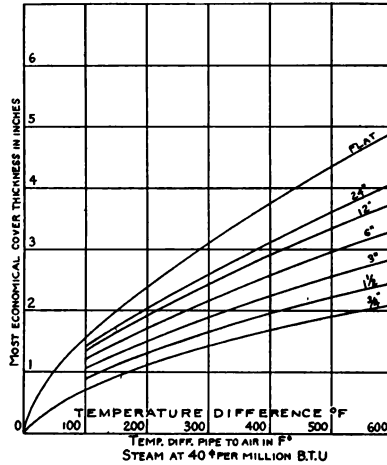
Size Pipe	Hot Water 175° F.	Steam 5 Lb.	Steam 100-200 Lb.	200 Lb. 150° F. Super-heat	200 Lb. 300° F. Super-heat
¾"	S	S	S	1½"	2"
1½"	S	S	1½"	2"	2"
3"	S	S	2"	2"	3"
6"	S	S	2"	3"	3"
12"	S	S	3"	3"	4"
24"	S	S	3"	4"	4"
Flat	2"	2"	3"	4"	4½"

COAL AT \$6.00 PER TON

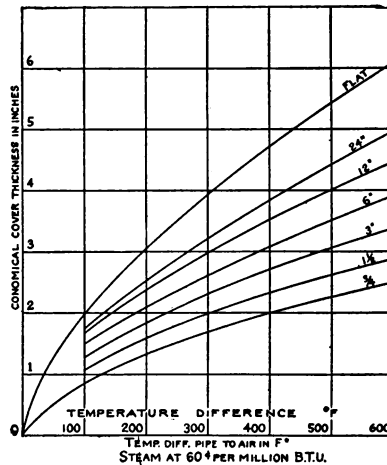
Size Pipe	Hot Water 175° F.	Steam 5 Lb.	Steam 100-200 Lb.	200 Lb. 150° F. Super-heat	200 Lb. 300° F. Super-heat
¾"	S	S	1½"	2"	2"
1½"	S	S	1½"	2"	3"
3"	S	1½"	2"	3"	3"
6"	S	2"	2"	3"	4"
12"	1½"	2"	3"	4"	4"
24"	2"	3"	3"	4"	5"
Flat	2½"	3"	4"	5"	5½"

(S indicates "standard" thickness.)

These curves are for use in plants where heat-costs, steam temperatures, etc., are accurately known. They are applicable to all heated surfaces since they are based on the temperature of the surface and the value of the heat in dollars per million B. T. U.



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A copy of the Magnesia Association Specification (compiled and endorsed by the Mellon Institute of Industrial Research) from which the above tables are taken will be sent on request to any engineer. Requests for additional information addressed to the Association or to individual members will receive special and prompt attention.

## H. W. JOHNS-MANVILLE CO.

NEW YORK CITY

10 Factories

Branches in 63 Large Cities

**Asbestos and Magnesia Products**

**Power Plant Specialties**

Johns-Manville Service to power-users has its effect in reducing the expense of plant maintenance. It acts through power conservation right back to the ultimate reduction of your bills for fuel and labor.

Johns-Manville Service embraces a complete line of maintenance materials designed to save heat, friction, wear and labor. The service rendered by each of these products is assured by Johns-Manville Responsibility, a business principle that places the user's satisfaction above all other considerations.

### JOHNS-MANVILLE INSULATIONS:

#### Heat Insulations

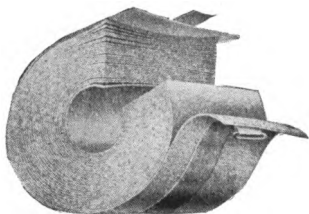
Asbestos-Sponge Felted Insulation (sectional, sheets and blocks).

85% Magnesia Insulation (sectional, sheets and blocks).

Asbestos Fire-Felt Insulation (sectional, sheets and blocks).

Thermo Fire-Felt Insulation (sheets and blocks).

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**Johns-Manville Asbestos-Sponge Felted Pipe Covering**

One of the Johns-Manville line of Pipe Insulations.

Vitribestos Insulation and Stack Lining (sectional, sheets and blocks).

Asbestocel Insulation (sectional, sheets and blocks).

Air-Cell Insulation (sectional, sheets and blocks).

Wool Felt Insulation: Standard, Champion, Aqua (sectional).

#### Cold Insulations:

Brine and Ammonia Pipe Insulation (built-up).

Anti-Sweat Insulation (sectional).

Zero Insulation (sectional).

### JOHNS-MANVILLE POWER PLANT SPECIALTIES:

Steam Trap  
Asbestos-Metallic  
Brake Blocks  
Refractory Cements

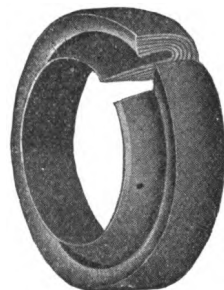
Aertite Boiler Wall  
Coating  
Stack Preservative  
Vulcabeston Pump  
Valves

### JOHNS-MANVILLE PACKINGS:

Sea Rings Rod  
Packing Ring,  
Spiral or Coil  
Kearsarge  
Universal  
Duplex  
Mogul  
Jewett

#### Sheet Packings and Gaskets

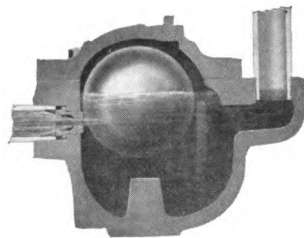
Service  
Seigelite  
Asbestos-Metallic  
Asbestos Fibre  
Mobilene  
Liberty Red Rubber  
and Asbestos Wick  
and Rope Packing



**Johns-Manville Sea Ring**

An automatic steam, air and hydraulic packing.

### JOHNS-MANVILLE STEAM TRAP:



Only three parts—the body, the rolling ball and the discharge bushing—nothing to get out of order.

### JOHNS-MANVILLE FIRE EXTINGUISHER:

Instantly extinguishes any type of incipient blaze.

#### Other Johns-Manville Products:

"Noark" Fuses and Electrical Materials, Asbestos Roofing and Siding, Fire Extinguishers.



# THE PICKERING GOVERNOR CO.

PORTLAND, CONN.

Manufacturers of Governors for Steam Engines and Turbines, Gas Engines, Mechanical Control and Speed Limit

## THE PICKERING GOVERNOR:

Owing to the absence of joints our Governors are very responsive to slight changes in load, moving quickly and positively into correct position for maintaining the admission of steam proportionate to the duty required of the engine. Absence of joints gives maintenance in efficiency under continued and severe duty.

Greatest range in speed adjustment with close regulation at all points.



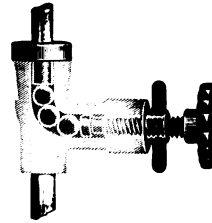
Fig. 33

Class B represents Governor with Speed Ranger by use of which the speed of Engine can be varied while in motion. Sawyer's Lever is also included.

All Governors equipped with Wide Range Speed Changer.

U. S. A. & Foreign Patents.

We build to meet special conditions whenever practical and are pleased to submit suggestions on request.



Detail of the Speed Ranger.

Fig. 34

Class A, to which is added the Automatic Safety Stop. This Stop closes valve when belt breaks or runs off Pulley, and is simple and certain in its action.



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*Pickering is standard for specifications in steam practice the world over.*



*We offer our services with over fifty years' successful experience.*

TABLE OF DIMENSIONS, ETC., FOR CLASSES A AND B

Size of Governor Diameter of Opening	1¼	1½	2	2¼	2½	3	3½	4	4½	5	6	7	8	9	10
From cen. of inlet to base	3¼	3½	4¼	4½	5¼	5½	6¼	7¼	7½	8	8½	9	10	11½	11½
Extreme Height.....	20¼	23¼	25¼	27¼	27½	32¼	33¼	41¼	41½	46¼	49¼	49½	53¼	55¼	60¼
Extreme Expan. of Balls	7	8	8	9	9	10	10	13	13	15	16¼	16½	18	20	20
Speed of Governor.....	350	380	380	300	300	340	340	320	320	275	275	275	260	260	225
Dia. of Pulley on Gov'r..	2½	3½	3½	4	4	4	4	5	5	5	6	7	7	8	8
Di. of Cyl 300 ft. P'n. Sp	6	7	9	10	12	14	16	18	20	22	26	31	36	40	45
Di. of Cyl 400 ft. P'n. Sp	5	6	8	9	10	12	14	16	18	20	23	27	31	35	39
Di. of Cyl 500 ft. P'n. Sp	4½	5	7	8	9	10	12	14	16	18	21	24	28	31	35
Di. of Cyl 600 ft. P'n. Sp	4	4½	6	7	8	9	11	13	15	16	19	22	25	28	32

For complete table and for sizes below 1¼—see our general catalogue.

# GREENE, TWEED & CO.

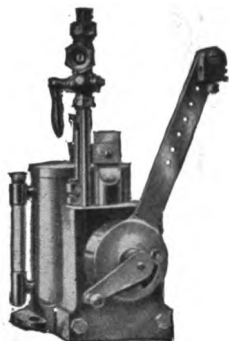
Established 1863

109 DUANE ST., NEW YORK

Manufacturers of Rochester Automatic Lubricators, Palmetto and Manhattan Packings, Wrenches, Belt Fasteners, and Other Mill Supply Specialties

## ROCHESTER AUTOMATIC LUBRICATORS:

For the lubrication of the cylinders of all types of Steam Engines and Pumps and Air and Ammonia Compressors.



202

Each feed regulated independently. Not affected by temperature, pressure or vacuum.

Working parts are made of steel, and all bearings case-hardened.

All sizes are fully nickel plated.

Equipped with Multiplus Sight Feeds and vacuum and check valves.

The mechanism of the Rochester Automatic Lubricator is compactly centered in a steel pump block, the principal working parts being enclosed and protected from dirt, grit, etc.

This block with all the mechanism can be almost instantly detached and removed, giving easy access to all the working parts for cleaning, repairing, etc., without disturbing the bowl or reservoir attached to the engine.

The Clutch Drive, while positively noiseless, is absolutely positive.

Notwithstanding the fact that the drive is a clutch drive, there is a regulating device whereby more or less lost

motion of the actuating arm can be caused.

The Clutch Drive Rochester is especially adapted for use on high speed engines, having been used with great success on an engine running at 800 r. p. m.

Can be furnished in the regular ratchet-drive model if desired.

No expense has been spared in the manufacture of Rochester Automatic Lubricators, efficiency and high quality being our aim rather than low prices.

## PRICE LIST

For Stationary and Marine Engines and Pumps

1/2 Pint Single Feed.....	\$20.00
1 Pint Single Feed.....	25.00
2 Pint Single Feed.....	30.00
3 Pint Single Feed.....	35.00
1/2 Gallon Single Feed.....	40.00
1 Gallon Single Feed.....	45.00
2 Pint Double Feed.....	45.00
3 Pint Double Feed.....	50.00
1/2 Gallon Double Feed.....	55.00
1 Gallon Double Feed.....	60.00
2 Gallon Double Feed.....	75.00
1/2 Gallon Triple Feed.....	70.00
1 Gallon Triple Feed.....	80.00
2 Gallon Triple Feed.....	90.00
1/2 Gallon Quadruple Feed.....	90.00
1 Gallon Quadruple Feed.....	100.00
2 Gallon Quadruple Feed.....	105.00
2 Gallon Quintuple Feed.....	120.00
2 Gallon Sextuple Feed.....	130.00
2 Gallon Septuple Feed.....	140.00
2 Gallon Octuple Feed.....	150.00

## For Air Compressors and Ice Machines

3 Pint Double Feed Two-Compartment.....	\$55.00
1 Gallon Double Feed Two-Compartment.....	65.00
1 Gallon Triple Feed Two-Compartment.....	85.00
1 Gallon Quadruple Feed Two-Compartment.....	105.00

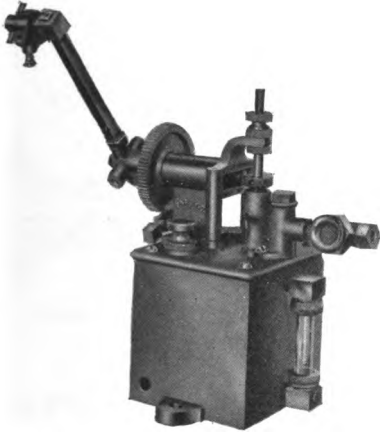
SEND FOR DISCOUNT.



## HILLS-McCANNA COMPANY

153 WEST KINZIE STREET, CHICAGO, ILLINOIS

Manufacturers of Force Feed Lubricating Pumps



**The Pioneer in the Force Feed Lubricator Field**—a pump built on honor, enjoying a reputation, for a quarter century, of perfect performance—an idea conceived and developed by us in answer to a demand for better lubrication methods.

The salient features of a Hills-McCanna pump are:

Ratchet Drive.

Sight Feed.

Positive Regulation over a wide range of deliveries.

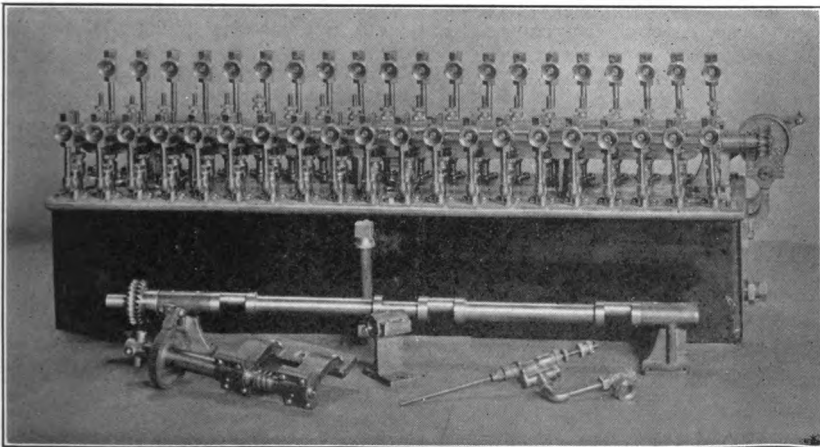
Valves and Operating Mechanism in view.

### A GET-AT-ABLE PUMP

Standard Stock sizes from one pint single to one gallon quadruple feed—special pumps in any required capacity up to nine-gallon, forty-two feed—separate compartments for different lubricants.

203

We may have some valuable suggestions in connection with the Lubrication in your plant.



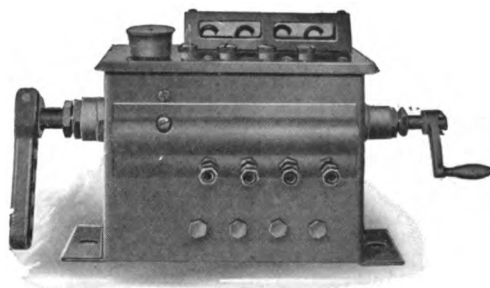
Hills-McCanna Nine-Gallon, Forty-Feed Pump

## MADISON-KIPP CORPORATION

Established 1898

MADISON, WISCONSIN, U. S. A.

Manufacturer of Fresh Oil Systems and Oil-Kipps



Model 50 Sight Feed Lubricator, Built in Any Number of Feeds. Data on Large Sizes and Special Lubricators Furnished on Request

204

	Capacity	Over-All Length	H'gt	Width
One Feed	5 Pints	11 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "
Two Feed	5 <sup>1</sup> / <sub>2</sub> Pints	12 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "
Three Feed	5 <sup>1</sup> / <sub>2</sub> Pints	13 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "
Four Feed	6 Pints	14 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "
Five Feed	6 <sup>1</sup> / <sub>2</sub> Pints	15 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "
Six Feed	7 Pints	16 <sup>1</sup> / <sub>4</sub> "	8"	4 <sup>1</sup> / <sub>2</sub> "

### MADISON-KIPP LUBRICATORS:

Madison-Kipp Fresh Oil Lubricators are standard equipment for compressors, steam engines, shop machinery, gasoline and oil engines.

More and more engine builders are using Madison-Kipp Lubricators in preference to other kinds.

The development of motor building makes plainer and plainer the Madison-Kipp superiority.

They are better in three outstanding things: First, the Madison-Kipp is

valveless; second, the entire mechanism is immersed in oil; and third, the feed adjustments are positive, the plunger stroke never varies, and a full supply of oil is unfailingly drawn in. The delivery is then automatically measured out by the controlled registration of ports in the hollow plunger, sleeve and barrel.

Our catalog gives a complete description of the Kipp Valveless Pumping Principle. If you haven't our catalog in your files, we will gladly supply this upon request.

Our engineering department is at your service to assist in laying out fresh oil lubricating systems for engines.

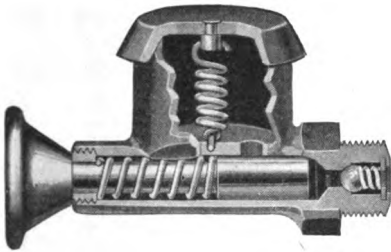
**FRESH OIL SYSTEMS**

# MADISON-KIPP CORPORATION

Established 1898

MADISON, WISCONSIN, U. S. A.

Manufacturer of Fresh Oil Systems and Oil-Kipps

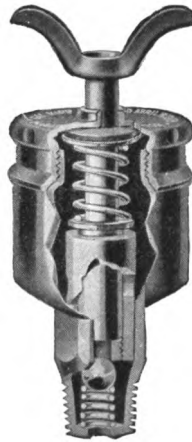


Model K Horizontal  $\frac{1}{8}$ " I. P. Thread

## MADISON-KIPP FORCE FEED OIL-KIPPS:

Inadequate lubrication on steering knuckles and shackle bolts of automobiles, as well as other non-rotating bearings, has long been a problem with engineers because of the shortcomings of grease cups and oil cups which depend upon gravity or wicks to carry the lubricant.

Oil-Kipps provide a sure, effective means of applying heavy or light oil to such bearings. They are easy to apply and convenient to operate. Raise or pull out plunger, then release, and the oil is forced by the spring action on the plunger.



Model H Vertical  $\frac{1}{8}$ " I. P. Thread

205

They have the  $\frac{1}{8}$ " pipe thread and where it is desired to replace old equipment for a different size thread, inexpensive adapters can be furnished. Even where end grease cups are integral with bolts, adapters can be fitted to accommodate Oil-Kipps.

Our booklet "Getting Rid of Grease with Oil-Kipps" gives full information as to the construction and application of them. Oil-Kipps have been found to give very good service on machine tools and other machinery, as well as automobiles, trucks and tractors.

## THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

Lubrication Engineers and Manufacturers

### R-P OIL FILTERS AND AUTOMATIC OIL CIRCULATING AND FILTERING SYSTEMS:

The distinguishing features of R-P OIL FILTERS, all of which are essential to an efficient power plant oil filter, are:

1—Dry System of Filtration. The oil does not pass through water.

2—Automatic Water separation and ejector of large capacity.

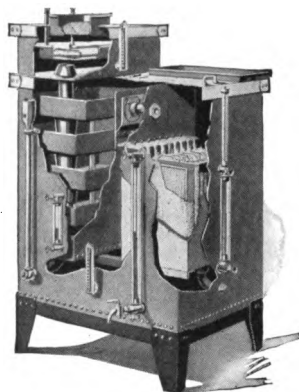
3—Filter cloth is arranged vertically and every square inch effective.

4—Multiple Unit design. Each filter unit can be separately removed and easily cleaned without stopping operation of filter.

206 5—Guaranteed to purify used oil so that the lubricating properties of the filtered oil are equal to new oil.

Illustrated and described in detail in Bulletin H-10. Ask for a copy.

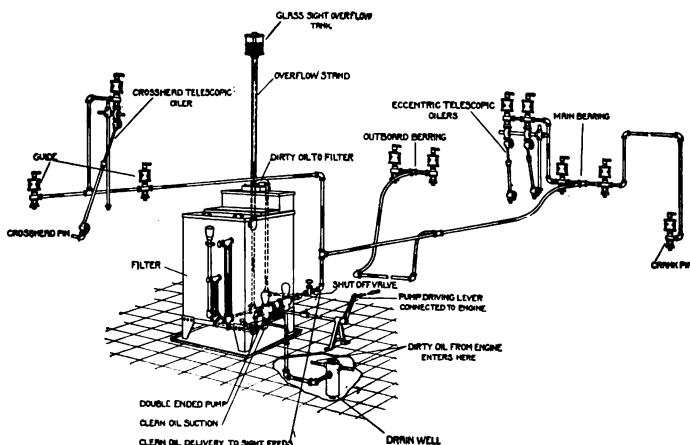
R-P OIL CIRCULATING AND FILTERING SYSTEMS use the same oil over and over again. They reduce oil consumption 50% to 90%.



These systems permit flooded lubrication on each bearing, reducing friction so that steam consumption is reduced 2% to 10%.

Entirely automatic in operation. Used oil is collected, purified and pumped back to the bearings in a cool, clean state each time it is used. Insurance against lack of proper lubrication is alone worth their cost. Simple, inexpensive and easily installed.

Write for Bulletin H-25, describing these systems.



Typical Installation of an R-P Type "R" Individual Oiling and Filtering System on a Simple Corliss Engine



## THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

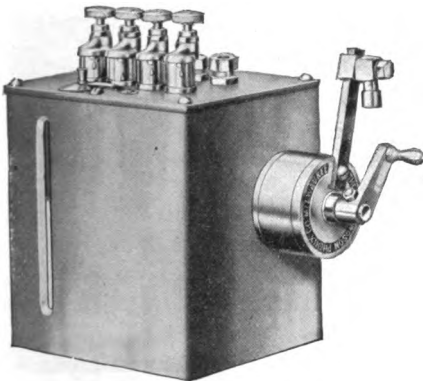
Lubrication Engineers and Manufacturers

### THE PHENIX MODEL "T" FORCE FEED LUBRICATOR:

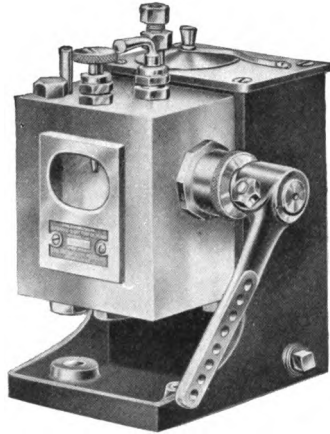
Each oil feed of every Phenix Model "T" Lubricator made is tested to pump against a pressure greater than 2000 lbs. Simple, durable, reliable. Size and frequency of oil drops can be seen in each feed. Each feed is adjustable while lubricator is operating. No gauge or sight feed glasses under pressure.

The ratchet wheel is fully enclosed. The drive is positive, it cannot slip.

**Suitable for high speed engines; Steam Pumps; Small Air Compressors; Auxiliary machinery such as Automatic Stokers. Especially desirable on machinery operating intermittently.**



### THE RICHARDSON MODEL "M" SIGHT FEED OIL PUMP:



207

The pumping plungers of a Richardson Model "M" Sight Feed Oil Pump can be synchronized with the pistons of an engine.

This is the only lubricator made that feeds a small drop of oil to the cylinders at each piston stroke.

Sturdy, simple, it is the most economical lubricator made.

**Essential for gas engines; Heavy Oil Engines; Ice Machines; Large Air Compressors, or Any Machinery where timed lubrication is desirable.**

Write for Bulletin H-60, describing this different lubricator.

# THE RICHARDSON-PHENIX CO.

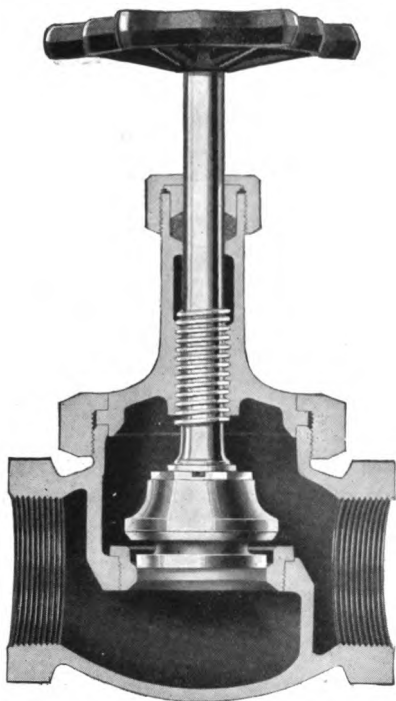
126 RESERVOIR AVE., MILWAUKEE, WIS.

Lubrication Engineers and Manufacturers

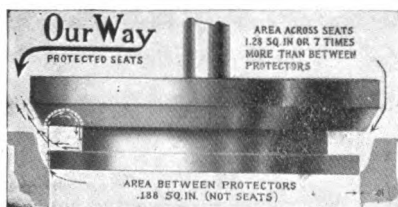
## R-P NOKUT GLOBE ANGLE AND CHECK VALVES:

The R-P NOKUT Valve has all the good points of any valve plus NoKut or protected seat.

208



A Protector Plug placed just below the valve disc seat throttles the flow of steam before the valve seats come together, thus preventing wire drawing. The NoKut Valve is better because:

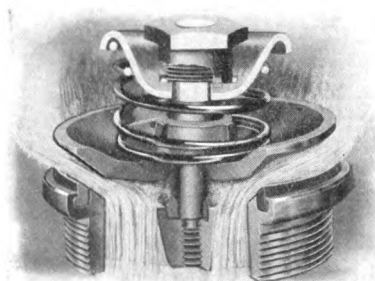


- 1—Port is plugged before the valve seats.
- 2—Valve unseats before port opens, except clearance of protectors (.01").
- 3—Greater area across the valve seats when opening.
- 4—Valve opens and closes under equalized pressure.
- 5—Velocity of fluid GREATLY REDUCED before crossing ground surfaces (the seats).
- 6—Wire-drawing or wear does not come on ground surfaces (the seats).
- 7—The unscored seats are always tight, preventing leaks.
- 8—Impact of fluid (steam, water, etc.) is not on ground surfaces (the seats)—see direction of flow as indicated by arrows on diagram below.
- 9—Large free opening through valve permits it to be used in place of gate valves.
- 10—Permits "warming up" without an auxiliary "By-pass."

STAY TIGHT OVER  
TWICE AS LONG!

Send for a copy of Bulletin H-100 describing the remarkable NoKut valve.

## R-P NOKUT PUMP VALVE:



Metal to Metal Seat with rubber seal.  
Long bearing on Stud. Only 3 arms, giving full area through seat.  
Low lift. Unrestricted stream line flow.

It is certainly worth investigating.  
Write for Bulletin H-100.

## **THE RICHARDSON-PHENIX CO.**

126 RESERVOIR AVE., MILWAUKEE, WIS.

**Lubrication Engineers and Manufacturers**

### **R-P ENGINEERING SERVICE:**

When purchasing or specifying a new engine or machine simply insert in your specifications the following paragraph:

**"Furnish and install complete and ready for operation one Richardson-Phenix Oiling and Filtering System, complete with Richardson-Phenix Force Feed Lubricators, Telescopic Oilers, Union Cinch Fittings and Sight Feed Oilers."**

The machinery builder will relieve you of any further bother.

A most efficient engineering department with twenty years' experience in the solution of unusual lubrication problems is at your disposal, gratis. Submit to us the details of any lubrication problem you have, whether Hydro-electric, Steam Turbine, Reciprocating Engine or Auxiliaries. We will be glad to aid you in solving it.

All R-P Lubricating Appliances are guaranteed as to workmanship and material for their life. Their satisfactory operation is also guaranteed. We consider that our obligation only commences when a sale is made, and we insist on coöperating with you in getting the satisfactory results you expect.

### **WE MANUFACTURE:**

209

**The Richardson Model "M"  
Sight Feed Oil Pump.**

**The Phenix Force Feed Lubri-  
cator.**

**The Peterson Power Plant Oil  
Filter.**

**Telescopic Cross-head Pin and  
Eccentric Oilers.**

**Central Oiling and Filtering Sys-  
tems.**

**A complete line of Oiling System  
Accessories.**

**R-P Motor Oil Purifier.**

**"NoKut" Globe, Angle and  
Check and Pump Valves.**

# McCORD MANUFACTURING CO.

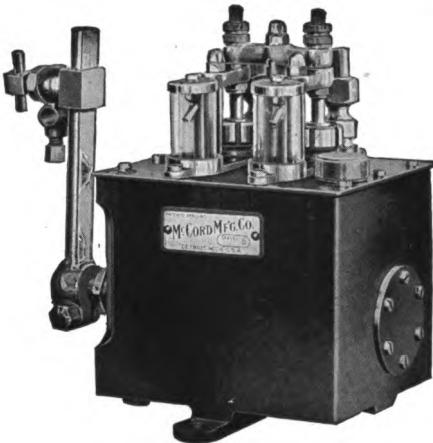
DETROIT, MICHIGAN

NEW YORK OFFICE  
165 Broadway

CHICAGO OFFICE  
Peoples Gas Bldg.

Manufacturers of Force Feed Lubricators, Gaskets, Automobile Radiators

## THE "McCORD" FORCE FEED LUBRICATOR:



Class B—Two Feed

It is made in from 1 to 14 feeds and has a separate pump for each feed. Each pump has individual adjustment. It has constant sight feeds which show exactly how much oil is being pumped to each bearing and the flow can be adjusted from one drop to a full stream per stroke.

It is positive and automatic in action and operates in perfect synchronism with the engine or pump it is lubricating. It is not affected by viscosity of oil, variations in steam pressure or length of feed lines.

### Note these standard features:

*Positive sight feeds without pressure.*

*Separate pumps capable of individual adjustment for each feed.*

*Forced delivery of oil against pressure up to 1000 pounds, etc., etc.*

### Note these special features:

*Heating Chamber.*

*Auxiliary Hand Crank for accelerating feed.*

*Sturdy operating lever.*

*Reversible End Bearing.*

*Plug for draining reservoir.*

There is positively no pressure in sight feed; all working parts are of the best drop-forged steel and operate in oil. Rotary or Ratchet drive. Finish—full Nickel Plate or Black Enamel and Brass. Straightaway Spring Check Valves. Heating Chamber and Auxiliary Hand Crank furnished as extras when specified.

### ALL PRICES F. O. B. DETROIT

No.	Capacity	Feeds	List
1	1 Quart	1 Feed	\$25.00
2	1 Quart	2 Feed	30.00
3	2 Quarts	1 Feed	28.00
4	2 Quarts	2 Feed	35.00
5	2 Quarts	3 Feed	42.00
6	2 Quarts	4 Feed	49.00
7	1 Gallon	1 Feed	33.00
8	1 Gallon	2 Feed	39.00
9	1 Gallon	3 Feed	45.00
10	1 Gallon	4 Feed	51.00
11	1 Gallon	5 Feed	57.00
12	1 Gallon	6 Feed	63.00
13	1½ Gallons	7 Feed	75.00
14	1½ Gallons	8 Feed	82.00
15	1½ Gallons	9 Feed	90.00
16	1½ Gallons	10 Feed	96.00
17	2 Gallons	11 Feed	108.00
18	2 Gallons	12 Feed	115.00
19	2 Gallons	13 Feed	125.00
20	2 Gallons	14 Feed	135.00

### DOUBLE COMPARTMENT LUBRICATORS FOR AIR COMPRESSORS AND ICE MACHINES

No.	Cap.	Feed	List
21	2 Qt.	2 Feed	1 Feed in ea. \$44.00
22	2 Qt.	3 Feed	2 & 1 Feed in ea. 50.00
23	2 Qt.	4 Feed	2 Feed in ea. 57.00
24	1 Gal.	2 Feed	1 Feed in ea. 47.00
25	1 Gal.	3 Feed	2 & 1 Feed in ea. 54.00
26	1 Gal.	4 Feed	2 Feed in ea. 60.00

For Heating Chamber add \$1.00 to list.

For Auxiliary Crank add \$1.00 to list.

See Catalog "T" for Details.

## ADAM COOK'S SONS, INC.

708-10 WASHINGTON ST., NEW YORK

Manufacturers of Lubricating Oils and Greases

### ALBANY GREASE:

Is a pure lubricant so compounded that it automatically maintains a film of oil between rubbing surfaces, reducing friction losses to a minimum. It contains no adulterants and is guaranteed not to oxidize, gum or corrode the metal of the bearings. Made in different consistencies to suit different temperature conditions.

Comparative tests made by Horace W. Gillett, A.B. Ph.D., at Cornell University of Albany Grease with other well-known lubricating greases using the Thurston and Olsen Machines, showed results which may be summed up as follows:

1st—Greases with a low melting point and with a low content of soap, should theoretically be the most efficient.

2nd—Tallow greases, of which Albany Grease is the best known and most widely used, are the only ones having a low melting point and a low soap content.

3rd—Albany Grease (a pure tallow compound) consistently showed its superiority to the other so-called mineral greases, compounded from mineral oil and lime soaps, not only at one pressure on the bearing, but at all pressures.

Albany Grease can be used in any kind or style of grease cup and will not gum, cake or clog, nor corrode.

It is economical because it stays where you put it and does not run or leak away. When the machine is not in operation, Albany Grease does not flow. It will flow just enough to give perfect lubrication—no more. These are facts that you should bear in mind when buying a lubricant.

Albany Grease will show wonderful results on Line Shafting and Loose Pulleys, also on Steam, Gas, Gasoline or Oil Engine Main Shaft Bearings, Crank Pins, Eccentrics and Slides. On special machinery, such as Printing Presses, Shoe Machinery, Coal and Metal Mine Equipment, Sugar Machinery, Cotton, Woolen and Paper Mill Installations, Lumber Camp Machinery, Wood Turning, Sawing Machines and in Steel Mills, it gives the best of service. In fact, no matter what kind of machinery you have, Albany Grease will lubricate it so that it will operate perfectly, keeping it cool and easy

running, and reducing depreciation to the minimum.

Albany Grease is made in seven different consistencies to meet various conditions and temperatures. Use the right consistency for your work and you will have absolutely no trouble.

**SOFT NUMBERS** (Nos. 0 and 1) for slow running, heavy machinery or where equipment is operated outdoors or low temperature has to be contended with.

**MEDIUM NUMBERS** (Nos. 2 and 3) for general machinery and shafting; the former is known as a winter grease and the latter as a summer grease. These are the most generally used consistencies.

**HARD NUMBERS** (Nos. X, XX, XXX) for use in places where the Soft and Medium numbers are not adaptable especially where the temperature surrounding the bearings is high. The No. XXX has the highest melting point with a great lubricating value.

211



TRADE MARK

Reg. U. S. Pat. Office

Due to the wide publicity given Albany Grease, unscrupulous concerns occasionally substitute inferior goods for our product. When purchasing Albany Grease, insist that our trade mark appears on the package.

We also refine and manufacture, in addition to Albany Grease, lubricating oils and greases to meet all requirements. No matter what your lubricating proposition may be, we can supply your entire wants. We will be glad to send complete data covering the entire lubrication of your equipment and place at your disposal expert engineering service.

## SWAN AND FINCH COMPANY

Established 1853

NEW YORK

PHILADELPHIA

HARTFORD

PROVIDENCE

CHICAGO

SAN FRANCISCO

Manufacturers of Lubricating Oils and Greases

### SCIENTIFIC LUBRICANTS FOR SCIENTIFIC LUBRICATION:

Swan & Finch Company are specialists in the manufacture of Lubricants.

It is our practice to study the requirements and the conditions of operation of different classes of machinery; then develop a lubricant to meet them.

In this way only can effective and economical lubrication be assured.

As a result of this common-sense method, and an experience of sixty-six years, we have evolved a line of lubricants unusual in character, value and variety.

212 The "Right Lubricant in the Right Place" habit which we have preached is being practiced on an ever-increasing scale. Industrial managers see the logic of it.



**SLO-FLO** is one of these specialties.

It is a slow-flowing, dripless, non-spattering product of mineral oil base. Its lubricating qualities are of the highest.

**SLO-FLO** is extensively used on Textile Machinery, Mine Cars, etc.

It is made in regular and white grades each in many densities from thin to heavy.

**CUPESE** is a better-than-ordinary cup grease carefully made by our exclusive process for all machinery uses.

It is produced in amber, white, yellow, amber-fiber and mixed smooth fiber grades, each in various densities.



**VESUVESE** is another specialty. It is a lubricant for wire rope and exposed gears. It is waterproof. It penetrates between the wire strands of rope, preventing corrosion and keeping the rope flexible.

### OTHER SPECIALTIES:

Automobile lubricants  
Core Oil for iron castings  
Heat-resisting lubricants, etc.  
Menhaden Fish Oil

### STANDARD ATLAS LUBRICANTS:

Engine Oils	Transformer Oil
Steam Cylinder Oils	Cutting Oils
Turbine Oil	Tempering Oils
Dynamo & Motor Oils	Quenching Oils
Compressor Oil	Spindle & Loom Oils
Gas Engine Oil	Wool Oils
Crank Case Oil	Leather Oils & Greases

# THE TEXAS COMPANY

Petroleum and Its Products

Lubricating Oils, Greases, Distillates, Fuel Oils, Asphalt, Roofing, Etc.

HOUSTON: THE TEXAS COMPANY BLDG.

NEW YORK: 17 BATTERY PLACE

Offices in Principal Cities

## TEXACO LUBRICANTS:

In your plant, Texaco Lubricants and Texaco Service will show the utmost efficiency and economy on engines, turbines, dynamos, motors and machines of all kinds.

The Texaco Line is complete, and includes:

Texaco Cylinder and Engine Oils

Texaco Turbine Oils

Texaco Machine Oils

Texaco Spindle Oils

Texaco Cutting Oils

Texaco Greases

Texaco Motor Oils

Texaco Ice Machine Oils

## TEXACO CRATER COMPOUND:

A heavy lubricant for gears and wire ropes. For use on heavy machinery in shops, mines, hoisting operations, construction work, etc.



## TEXACO SERVICE:

Users of power and manufacturers of all types of machinery are invited to avail themselves of Texaco Lubrication Engineering Service.

For the power user we are prepared to make a complete inspection of the plant and recommend the proper lubricants for machinery and power units. We are helping many power plants to secure increased operating and production economies.

213

For the manufacturer of machinery, our force is prepared to prosecute experimental research to determine the most suitable lubricant or lubricants for the machinery produced, with the sole idea of enabling the manufacturer to enhance and maintain the service of his product after it leaves his hands.

We welcome inquiries regarding our products or on any subject relating to the scientific use and application of lubricating oils.



## TIDE WATER OIL COMPANY

11 BROADWAY, NEW YORK  
Manufacturers of Petroleum Derivatives

---



*The Tide Water  
trademark has a  
recognized value  
all over the world*

### FUEL OIL:

214 Fuel oil eliminates firemen, coal passers, ash wheelers, and tube blowers; solves ash removal problems; saves labor costs in handling; increases the capacity of each boiler 35% to 50%. Yet the change from coal to fuel oil for raising steam can be made easily and quickly. The cost is returned in a few months by the economies of operation.

Fuel oil is supplied in three grades, 18°-20°, 24°-26°, 28°-36° BÉ.

The Tide Water Oil Company combustion engineers are available for consultation on your problems. Write for the Tide Water scientific booklet on fuel oil.

### COMMERCIAL GASOLINE:

Gasoline for manufacturing purposes from the Tide Water Oil Company is available in any quantities. Scientific laboratories and an inspection department maintained at a cost of \$75,000 annually, assure uniform quality and exact compliance with standard specifications. Rule-of-thumb methods are not tolerated. Consult our gasoline engineers on your special, large quantity requirements.

Commercial gasoline is supplied according to special specifications.

### LUBRICANTS AND OTHER PRODUCTS:

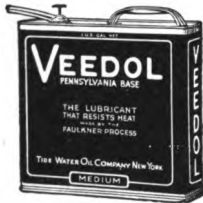
Cylinder oils, engine oils, turbine oils, machine oils, marine oils, white oils, miscellaneous greases, petrolatum, gas oil, paraffine wax, petroleum coke, pitch.



# TIDE WATER OIL COMPANY

11 BROADWAY, NEW YORK

Manufacturers of Petroleum Derivatives



*The Veedol can is of a distinctive design that is both striking and attractive. It is black with orange lettering, making a strong display.*

## VEEDOL OIL AND GREASES:

Leading high grade lubricants for gas engines. Made in special grade for every purpose. Veedol lubricants resist heat.

## TYDOL MOTOR GASOLINE:

Fast vaporization and maximum power are characteristic of Tydol, which has become famous as "The Economy Gasoline." It burns up cleanly, keeping the cylinders, valves and manifolds free from carbon.

## KEROSENE:

Snowflake, water white 150°; Chester, standard white 130°; Stella, standard white 110°.

## KEEPING 150 PRODUCTS UP TO SCIENTIFIC STANDARDS:

Tidewater capabilities are illustrated by the fact that at the Bayonne plant, 15,000–20,000 barrels of crude oil are received daily. 1,814 miles of pipe line in the Pennsylvania fields gather crude for the Tide Water trunk lines across the mountains. 500 steel tanks with an aggregate capacity of 1,500,000 barrels **215** are used for storage.

Unequalled shipping and packing facilities have been provided. Private docks accommodate sea-going vessels. The company owns its tank cars and bulk lighters. The barrel factory turns out 3,000 barrels daily, the can factory 36,000 five-gallon cans daily, the box factory 18,000 boxes.

Each of the 150 products of the Tide Water Oil Company is the best that choice of raw material, years of experience and scientific research can produce.

## AKRON METALLIC GASKET CO.

152 N. UNION ST., AKRON, OHIO

Manufacturers of Corrugated Copper Gaskets; Copper Asbestos Gaskets; Akro-Metal Corrugated Gaskets for Superheated Steam; Special Gaskets any Shape or Size of Copper, Lead, Steel, Tin, Aluminum, Monel Metal, Brass, Etc.  
Gaskets cut from Akronite Sheet Packing

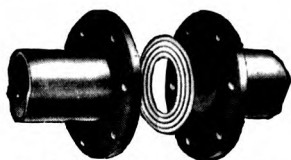
### AKRON METALLIC GASKETS:

We make 6 types of Flange Gaskets of metal and of metal and asbestos combination.

These gaskets are made to serve different purposes—for all pressures, for saturated, dry and superheated steam, for new, well-aligned pipe work, for compactly built plants, for extra long pipe lines, for poorly aligned piping, for rough flanges.

216 We are prepared to furnish Akron Metallic Gaskets to meet all requirements.

FULL FACED gaskets punched with Bolt Holes.



Ring Type Gasket Fit Inside Bolts

Gaskets and washers  $\frac{1}{4}$  inch to 10 ft.

"Akro-Metal" Corrugated Gaskets guaranteed for 5 years on Highest Superheated Steam.

We make:

The "Akron Gunmetal" Gasket.

The "Summit" Copper Asbestos Filled Gasket.

The "Duplex Akron" Copper Gasket.

The Akron Copper Asbestos Ribbed Gasket, in 3 types.

Regular No. 27 Gauge Copper Gaskets.

Regular No. 27 Gauge Steel Gaskets.

Manhole Gaskets.

Lead Ammonia Gaskets.

Special Metal Gaskets.



Asbestos Filled

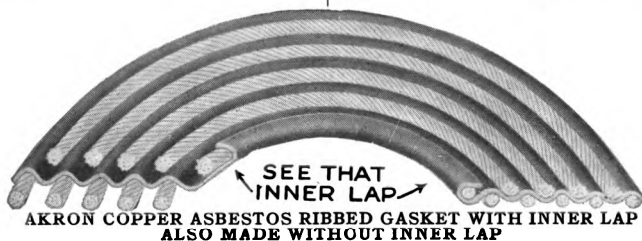


Corrugated Special Shaped Gasket

WE SHIP QUICK AND APPRECIATE YOUR BUSINESS.

When in need of gaskets for any purpose let us quote.

Send for our complete catalogue.



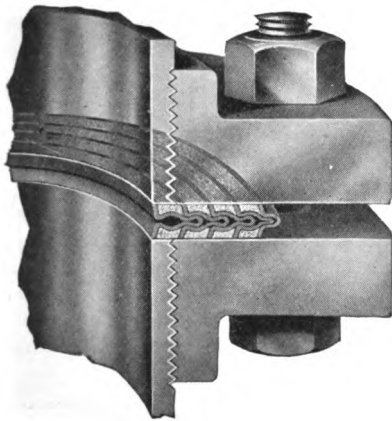
SEE THAT INNER LAP  
AKRON COPPER ASBESTOS RIBBED GASKET WITH INNER LAP  
ALSO MADE WITHOUT INNER LAP

# "FLEXITALLIC" GASKET COMPANY

CAMDEN, N. J.

Manufacturers of Patented "FLEXITALLIC" (Trade Mark) Gaskets

"Flexitallic" will positively take care of expansion, contraction or vibration and is the only gasket which does not have to be followed up.



Made of a single strip of metal specially formed and designed to successfully resist the highest pressure and most intense heat. This metal is wound in a spiral dove-tail shape, starting on the inside and working out ply by ply to the size gasket required. Between each ply of metal, on either side, is a cushion of water-proofed asbestos spirally wound to conform with metal strip. This asbestos is put in place under enormous pressure, and will not dissolve or deteriorate under the most trying conditions. As the metal

is built up on edge at right angles to the line of pressure, it is positively blow-proof.

It is not necessary to use the largest wrench in the shop plus a length of pipe in order to make "Flexitallic" Gaskets tight. Nor is it necessary to "follow-up" to take up the slack as when rubber or fibre gaskets are used. Unlike other gaskets of a perishable or a deteriorating composition, "Flexitallic" Gaskets may be kept in stock and are always ready for instant service.

217

"FLEXITALLIC" GASKETS make good our guarantee of 100% Efficiency and Satisfaction.

"Flexitallic" is specially well adapted for use on exposed pipe lines, which are subject to rapid expansion and contraction; on fittings in connection with superheaters, steam hammers or any service where difficult problem of steam conveying is to be met. Also, most satisfactory in the man-hole and hand-hole openings on boilers. Indispensable on water tube boilers.

Circular and price list on request.

Order through your dealer, jobber or direct.

# GOETZE GASKET AND PACKING CO.

22 ALLEN AVE., NEW BRUNSWICK, N. J.

**Metal Gaskets of Various Types. Metallic Engine Packing. Sheet Packing for Flanges. Valve Gaskets or Discs**

## GOETZE NO. 2 ELASTIC GASKET:

A Copper-Asbestos Gasket—the copper is corrugated and the closely twisted asbestos is held in the corrugation as shown in the cut at the right.

One of Goetze No. 2 Gaskets will make a tight joint where several of other kinds fail to hold. It is recommended

218



for high pressures, high temperatures and the most exacting service generally.

When used for flanges, it makes a joint practically as leak-proof as the pipe itself, even with the roughest, most uneven surfaces.

Guaranteed for five years and sent on 90 days' trial.

## GOETZERIT GASKETS:

$\frac{1}{16}$  Inch Thick

In Sheets

about 50 inches square,  $\frac{1}{32}$ ,  $\frac{1}{16}$ ,  $\frac{1}{8}$  inch thick. Weight, about 5½ ounces per square foot  $\frac{1}{32}$  inch thick.

\$1.00 per pound.



We have perfected in our "Goetzerit," a sheet packing which is easily the best of its kind.

"Goetzerit" is made from pure prime asbestos fiber compressed under an exceedingly high pressure. It is impregnated with a substance which makes it absolutely proof against the action of high-pressure superheated and saturated steam ammonia air acids.

## GOETZE'S VALVE GASKETS OR DISCS:

These are intended for valves of the Jenkins type and are made of copper and asbestos. The illustration shows a plan and section and it will be noticed that the hole has two flat sides as is common in most makes of valve discs. They are made in the following sizes:  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , 3,  $3\frac{1}{2}$ , 4,  $4\frac{1}{2}$ , 5, 6, 7, 8, 9, 10 and 12 inches.

It's the best because it lasts the longest.



## THE UNITED STATES METALLIC PACKING CO.

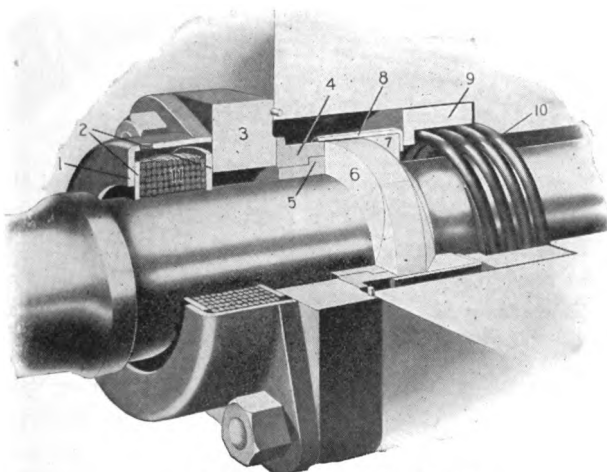
FACTORY  
429 N. 13TH ST.

PHILADELPHIA, PA.

GENERAL OFFICES  
221 N. 13TH ST.

BRANCH OFFICES: NEW YORK AND CHICAGO

**Manufacturers of Metallic Packings for Locomotive, Marine and Stationary Engine  
Piston Rods and Valve Stems; also other Locomotive Appliances**



King Piston Rod Packing

219

### KING PACKING:

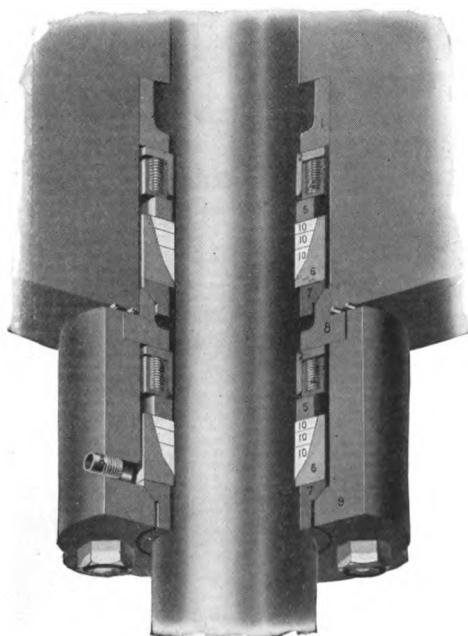
For locomotive piston rods, valve stems and air pumps has demonstrated its simplicity, efficiency and economy on a majority of the locomotives in the country. Designed and manufactured in a manner to meet the extreme requirements of modern railway service.

### CLASS NO. 1 PACKING:

Used in a majority of cases by us for packing marine and stationary engines.

We manufacture other designs of metallic packings for marine and stationary service, varying the design to suit the requirements.

*Send for catalog describing these packings and other products.*

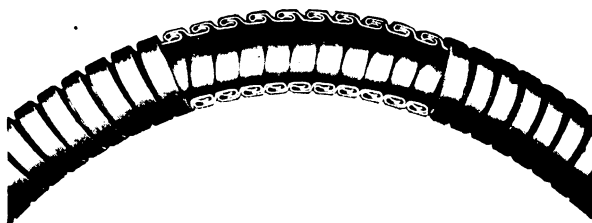


Class No. 1 Packing

## THE AMERICAN METAL HOSE CO.

WATERBURY, CONN.

Manufacturers of Flexible Metal Hose and Tubing



**AMERICAN METAL HOSE** is, from its very nature, a hard service, high pressure Hose. In our "BD" patterns (Interlocking construction) we offer the most economical Hose made for the conveying of Steam and Oils. Our Hose is particularly adapted to these services as it is impervious to the intense heat of Steam and the chemical action of Oils.

220

**AMERICAN FLEXIBLE BRONZE STEAM HOSE** (BD15) costs very little more than rubber hose, and will last many times as long.

**AMERICAN FLEXIBLE STEEL OIL HOSE** (BD15) actually costs less than rubber in the first place, and will render infinitely better service.

While rubber hose will give fairly good results when used in certain easy duties such as carrying Air and Water, it will not satisfactorily convey Steam or Oils and when used for this kind of work, the frequent replacements necessary make its cost excessive.

American Interlocked Hose is not only adapted to the handling of Steam and Oils, but to a wide variety of other duties. We make several other types of Flexible Metal Hose for special classes of work.

In addition to being the most economical Hose on the market today for any of the heavy duties, **AMERICAN METAL HOSE**, on account of its permanent nature, makes an admirable substitute for swinging or telescoping joints and rigid piping on machines where a flexible connection is desired for use in conveying Steam or Oils. It is particularly adapted to use on presses where a constant supply of Steam must be fed to the moving parts.

We are prepared to furnish Couplings of any description with our Hose.

SEND FOR CATALOGS AND FULL INFORMATION.



# THE B. F. GOODRICH RUBBER CO.

AKRON, OHIO

Offices in all principal cities

Manufacturers of Mechanical Rubber Goods, Tires, Etc.

## HOSE:

**Goodrich Hose** is made to meet every conceivable need for hose in Industry. Goodrich has been making Hose for fifty years, and gaining reputation each succeeding year.

**Water Hose** is made in a wide range for every purpose.

"COMMANDER" is of the highest grade for unusual and heavy conditions of service.

"TRITON," "CASCADE," "DELUGE" are regular grades for all general purposes.

"AKRON" and "JUPITER" are braided fabric water hose made in any length up to 500 feet.

**Steam Hose.** Heavily constructed to withstand high pressure, and in all cases the inner lining specially prepared to withstand the action of steam under varying temperatures.

"SUPERHEAT" for unusual and most severe service conditions is constructed in every detail for gruelling conditions.

"GOODRICH," for high-pressure steam and long life as well.

**Pneumatic Hose.** Wrapped duck in lengths of 50 feet.

"GOODRICH," the highest quality for hardest service.

"AKRON," the standard wrapped hose for all general purposes.

"COMMANDER," "MAINSTAY" and "MAXECON" *braided* pneumatic hose made in any length up to 500 feet.

**Air Drill Hose.** "GOODRICH" braided, and "QUARRY" wrapped, both unequalled for hard wear.

**Boiler Washout Hose** is made with special attention to the hard usage that hose always receives when used for this purpose. Several grades of proven quality are made.

**Suction Hose** is made in various grades, either smooth or rough bore, to suit any service. DREDGING SLEEVES, OIL SUCTION HOSE, OIL-WELL DRILLERS' HOSE, OIL CONDUCTING HOSE, GASOLINE HOSE, SAND BLAST HOSE, COKE HOSE, DECK HOSE, etc., and any hose for any purpose—Goodrich makes it.

## PACKING:

**"Superheat" Packing.** A combination of rubber and specially selected long fiber asbestos. "Superheat" is a necessity where high pressures are encountered.

"RED SHEET PACKING" with brass wire insertion. "DIAPHRAGM and CLOTH INSERTION," "RED TUBULAR GASKET PACKING," "SPIRAL SQUARE DUCK PACKING," "ROUND" and "SQUARE" Duck Packing, "SQUARE RUBBER BACK PISTON PACKING," "PURE GUM STRIPS."

## GASKETS:

"RED SHEET GASKETS" and "SUPERHEAT" SHEET GASKETS.

## GOODRICH RUBBER PUMP VALVES: 221

There is no class of our products that we take greater pride in stamping with our trademark, than these. Our list of grades is complete, and we are glad at all times to give special attention to unusual conditions and sizes. Made in grey or red rubber.

## MOLDED RUBBER GOODS:

We have a large Department devoted exclusively to the manufacture of molded rubber articles of every description: Diaphragms, Bumpers, Springs, Cushions, Tips, Balls, Billiard Cushions, Respirators, Rubber Mallets, Soles and Heels, Parts for Automobiles, Truck Wheel Tires, Discs for Steam and Radiator Valves, special articles used in connection with the Oil Industry, Sugar Factories, Creameries, Breweries, Laundries, Rubber parts for Plumbing devices, Carpet Sweepers, Vacuum Cleaners, etc. A large part of this class of our business lies in the direction of strictly special articles made to customers' specifications. Our products are uniform in their good quality and excellent finish.

## QUAKER CITY RUBBER COMPANY

PHILADELPHIA, PA.

CHICAGO

BRANCHES:

PITTSBURGH

NEW YORK

**Manufacturers of High Grade Rubber Belting, Hose, Packings, Mechanical Rubber Goods, Automobile Tires and Tubes**

### BELTING—TRANSMISSION:

Made in several grades to meet various working conditions. IRONSIDES is a frictioned surface belt in a class of its own, being the ultimate in belt quality. For main drive and severe conditions.

### QUAKER CITY:

A superior belt, rubber covered, with heavy duck and strong friction, for general purposes.

### CROWN:

A strictly high grade belt. For use where conditions are not extraordinarily severe this belt will give entire satisfaction.

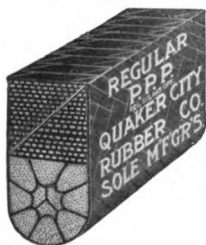
### BELTING—CONVEYOR:

222 For the conveying of ore, sand, gravel, stone, coal, grain. Conveyor Belting can be furnished on short notice for any purpose, any length, width or thickness desired.

DESERT is our leader in the conveying field and is designed especially to meet hard conditions.

CROWN is for general service and HERCULES is a thoroughly good belt for the lighter class of conveying duty.

### ROD PACKING:



Daniel's P. P. P. is unquestionably the finest rod packing. Unequalled for the packing against steam, water, air, ammonia and other fluids on engine, pump and compressor rods, etc.

### SHEET PACKING:



EBONITE has been found to be the most serviceable packing for high pressures, superheated steam, hot water, ammonia, oils, acids and all other kinds of joints requiring packing.

### HOSE:

We manufacture rubber hose for every purpose. Each grade and brand is made with special care to render the best service for which it is intended.

### STEAM HOSE:

EBONITE for high pressures and high temperatures, made with tube of same composition as our celebrated Ebonite Sheet Packing and strong, tough cover. We warrant EBONITE to be the equal or superior of any hose for steam purposes.

### QUAKER CITY AND CROWN:

Well made and will give good results for moderate or low pressures.

### WATER HOSE:

QUAKER CITY our first grade. Distinctly a quality hose. Recommended for hard duty.

CROWN: Will give excellent service and stand high pressures.

HERCULES: For medium grade work this hose cannot be equalled.

### AIR DRILL HOSE:

AERO and GIRARD are made to satisfy a demand for a light weight hose, yet capable of standing high pressure and severe usage of mining work.

### PNEUMATIC TOOL HOSE:

RINGMETER and YANKEE in braided moulded continuous length up to 500 feet.

### EBONITE:

Wrapped construction in 50 ft. sections.

BOILER WASHOUT, FIRE, ACID, COKE, CHEMICAL, OIL SUCTION and DISCHARGE, OIL DRILL, GASOLINE SUCTION, SAND BLAST, etc.

### PUMP VALVES:

Valves for hot or cold water, ammonia, acids, oils, air condensers, blowing engines, boiler feed-water pumps, mine pumps, marine pumps, air pumps, etc.

Gaskets, Moulded Goods, Tubing, Mats and Matting, Diaphragms, Washers and complete line of Mechanical Rubber Goods.



**CATALOGUE SECTION  
PART II**

**Testing, Measuring and  
Recording Apparatus**

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**Pages 225-258**



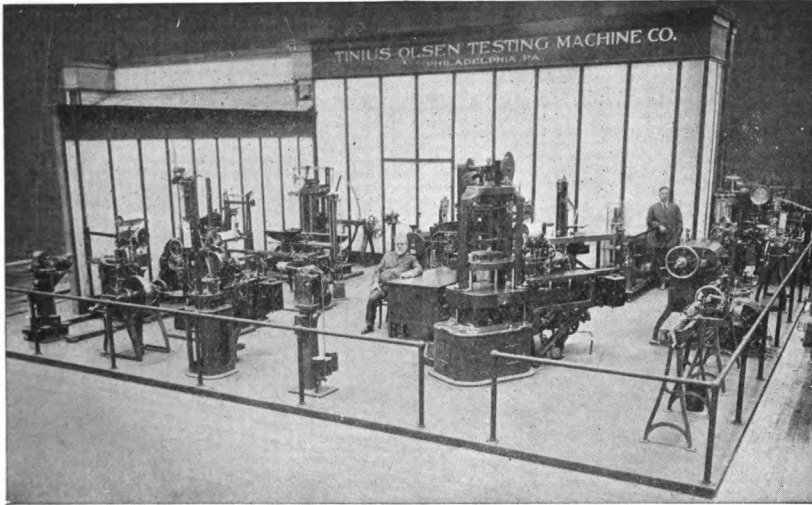
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## TINIUS OLSEN TESTING MACHINE CO.

500 NORTH 12TH St., PHILADELPHIA, PA.

**Manufacturers of Testing Machinery and Instruments**

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225

### **OLSEN TESTING MACHINES:**

The above illustration is our exhibit of testing machinery at the Panama-Pacific International Exposition in San Francisco which covers the most complete up-to-date testing laboratory ever demonstrated.

This exhibit was awarded GRAND PRIZ, the highest and only award of this kind ever made to a testing machine manufacturer.

In this exhibit are thirty different types of testing machines with the addition of a complete set of accessories and instruments. The exhibit is illustrated and described by our souvenir exposition pamphlet entitled "Olsen Testing Machines," which will be mailed on request.

We are the largest manufacturers of high-grade testing machines in the world.

Builders of the largest testing machine in the world of 10,000,000 lbs. capacity used by the U. S. Bureau of Standards, at Arsenal Grounds, Pittsburgh, Penna.

Our Catalog covers all the latest up-to-

date testing machines and is divided into eight parts as follows:

Part A—Universal Testing Machines and Instruments.

Part B—Spring Testing Apparatus and Machinery.

Part C—Cement, Concrete and Road Materials Testing Machinery.

Part D—Cloth, Yarn, Paper, Rubber and Leather Testing Machinery.

Part E—Wire, Chain and Anchor Testing Machinery.

Part F—Oil Testing Machinery and Dynamometers.

Part G—Transverse and Beam Testing Machines. Foundry Testing Machines.

Part H—Special Testing Machinery, Including Impact, Indentation, Vibratory, Bending, Hardness, Endurance, Torsion, Fatigue and Efficiency Testing Machines.

Any parts will be mailed on request.

Testing machines designed and built to meet any special requirements.

Our experts will be glad to recommend and lay out complete testing laboratories when desired.

# RIEHLÉ BROS. TESTING MACHINE CO.

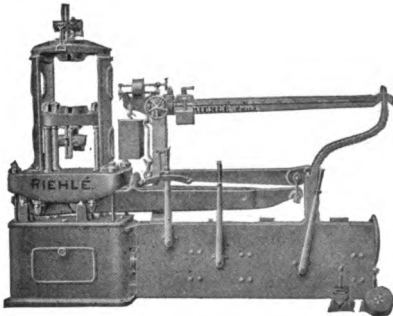
1424 NORTH 9TH STREET, PHILADELPHIA, PA.

Manufacturers of Testing Machines and Testing Appliances

## RIEHLÉ TESTING MACHINES:

Are used by the leading Colleges, Steel and Iron Works, United States Government, many foreign Governments, and are recommended by many of the most prominent and successful Engineers throughout the world. We design and build these machines from 5000 lbs. to 2,000,000 lbs. and over in capacity for the determination of any physical property.

226



Riehle U. S. Standard Vertical Screw-Power Testing Machine. Three-Screw Type, 100,000 Lbs. Capacity

## Features of Riehle Testing Machines:

- Designed Right.
- Plenty Strong Enough.
- No Sparring of Material.
- Long Base Lines.
- Simple in Construction.
- All parts Accessible, without taking whole machine apart.
- Fine Finish. Attractive in Appearance.

## NOTE:

We are now building all the Riehle Vertical Screw Power-Testing Machines with two (2), three (3), or four (4) Main Pulling Screws as may be desired.

For quick and convenient reference our complete line of Testing Machines is catalogued as enumerated below:

## RIEHLÉ TESTING MACHINE CATALOGUE "A:"

Illustrating and describing all the large Riehle U. S. Standard Testing Machines, Screw and Hydraulic Power, also new and ingenious tools for same; Machines for Long Transverse Members, Torsional and Impact Testing, also Calibrating Levers.

## RIEHLÉ CATALOGUE "AA" OF EXTENSOMETERS, COMPRESSOMETERS, AND TORSION METERS:

Containing illustrations and descriptions of the very latest and best Riehle Extensometers.

## RIEHLÉ TESTING MACHINE CATALOGUE "B:"

Embracing all the various styles of Riehle U. S. Standard Testers for Wire, Cloth, Canvas, Cord, Twine and Textile Fabrics of all kinds, also for every variety of test. This catalogue is well worth your careful perusal.

## RIEHLÉ CHAIN TESTING MACHINE CATALOGUE "C:"

In this Catalogue is found all that is *newest and best* in Testing Machinery for Chain, Wire, Hemp, Rope, Eye-Bars, Bridge Irons, etc. Special Machines for different forms of materials can be designed along these lines. We also furnish Hydraulic Pumps separately if desired. We claim these Machines are the Strongest and Best in the World.

## RIEHLÉ TESTING MACHINE CATALOGUE "D:"

Containing illustrations of Transverse Bending, and Special Testing Machines, Rope Twisters, Loam Mills, Pipe Provers, etc. Every Foundry and Machine Shop should install some of the articles shown in this Catalogue.

## RIEHLÉ TESTING MACHINE CATALOGUE "E:"

Those interested in Machines for testing Springs of all kinds, also Oils and Bearing Metals, are especially referred to this Catalogue for all the newest and best Machines.

## RIEHLÉ CATALOGUE "F:"

In this Catalogue are presented illustrations and descriptions of superior designs and patterns of Hand and Power Hydraulic Pumps and Presses, also Riehle-Robie Patented Screw Jacks, etc.

## RIEHLÉ CEMENT-TESTING MACHINE CATALOGUE "G:"

In this Catalogue one will find "everything that is good" in the way of testing Cements, Asphalts, Building Material, and also every conceivable article for thoroughly equipping a Physical Testing Laboratory for that kind of work. Be sure and send for this Catalogue.

## RIEHLÉ ROAD MATERIALS TESTING MACHINE CATALOGUE "H:"

In this Catalogue you will find illustrations of everything to make tests of Road Materials, as used by the United States Government, Department of Public Roads, Washington, D. C.

Select the Catalogues you want when ready to order.

*We are the oldest and largest Testing Machine manufacturers in the United States. Established nearly 50 years ago.*

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## AMERICAN KRON SCALE CO.

430 E. 53RD ST. (Dept. B), NEW YORK

Manufacturers of the Kron Automatic Springless Dial Scale

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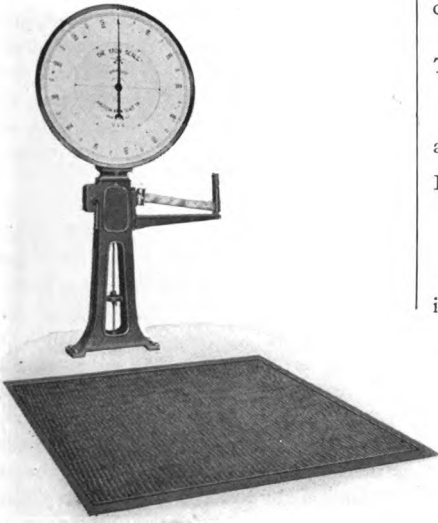
### THE KRON SCALE:

**Automatic—Springless**

**"LOAD AND LOOK"**

The Kron Scale is an automatic weighing indicator for light and heavy work. All parts interchangeable regardless of capacity. Entirely free from springs. All metal construction. *It seals itself.*

Made in U. S. A.



### Advantages of the Kron Scale:

Where rapid and accurate weighing is desired the Kron scale should be installed.

*The Kron is Automatic.* It is the only scale that will indicate the total load on the dial without any manipulation of extra weights or sliding poises.

*The Kron is Non-Vibrating*—the pointer always stops "dead" at accurate weight.

*The Kron is Highly Sensitive*—but it is not delicate and parts can be replaced within a very few minutes.

*The Kron is Strongly Built upon a Proven Principle*—hence its maintenance cost is practically nil.

### Types of the Kron Scale:

Made in all types and capacities from a 30" Hanging Pan Scale to Industrial Railway Scale up to 15 tons.

227

**The Dormant type** shown on this page is equipped with tare beam and locking lever. Suspension type platform with Kron diamond checkered steel top. Capacity 500 lbs. to 10,000 lbs. Platform Dimensions 33" x 33" to 96" x 54".

**Portable types** made with platform size 24" x 24" and upward. Capacities, 200 lbs. and upward.

Travelling Crane Scales; Hopper Scales; Dormant Pitless Suspension Scales and Special Scales.

*Branch Offices and Service Stations in Principal Cities.*

## RICHARDSON SCALE COMPANY

PASSAIC, N. J.

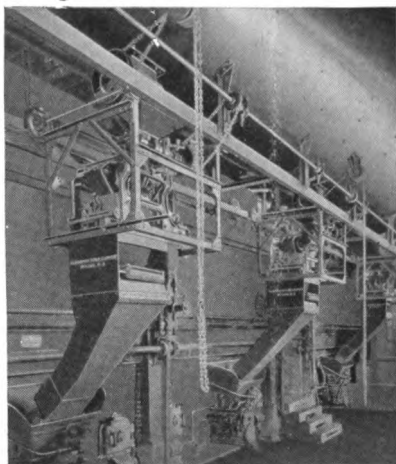
Branches in all large cities

**Automatic Scales for Weighing All Kinds of Crushed, Granular, Lumpy and Powdered Materials; also Scales for Weighing Liquids**

### RICHARDSON AUTOMATIC BOILER SCALE:

Like all Richardson Automatics, the Boiler Scale is built on the equal balance principle. Suspended on the opposite ends of an equal arm beam balanced in the center are a hopper and a weight box that exactly balance each other when empty. When the weight of material in the hopper equals the weights in the weight box, the beam comes to a balance, simultaneously cutting off the stream above and opening the hopper door causing the scale to discharge.

228



Three Richardson Automatic 100-lb. Boiler Scales Installed at the Plant of Philadelphia & West Chester Traction Co., Lanerch, Pa.

Richardson Automatic Boiler Scales weigh coal as it is fed to each individual fire and record the weights on individual

engine counters. They receive, weigh and discharge from bunker to boiler without HUMAN ASSISTANCE.

On an average the cost of coal is 60% of Steam Power Plant expense. The vital problem confronting the power plant operator today is to keep track of what his boilers are doing and to maintain them at all times at their best efficiency. Coal, the principal steam power plant expense, is the easiest item to save on.

The automatic counter substitutes mechanical accuracy for man-made errors in compiling the records of coal consumed. After all, your firemen are firemen and not well-paid accountants and it is not fair to expect them to compile records and always get them right.

Richardson Automatic Coal Scales can be installed wherever overhead bunkers afford a gravity feed or wherever it is possible to elevate the coal in storage above the scale. If your coal will leave the bunker, the scales will automatically receive, weigh and positively discharge it to the stoker hopper or boiler room floor without hold-up. Their rugged construction is a guarantee against breakdowns. The accuracy is within  $\frac{1}{2}$  of 1%. These scales are built to weigh coal and nothing but coal and the ordinary foreign matter found in it. They represent years of experience and research.

The reading of the counter compared with boiler output shows actual efficiency. A comparison of the readings for the different boilers shows relative efficiency. Wasteful firing, dirty boiler tubes, scale and improper draft are instantly detected.

# JOHN SIMMONS CO.

119 CENTER ST., NEW YORK, U. S. A.

Steam and Mechanical Specialties

## LEINERT AUTOMATIC GRAVITY SCALES:

For Measuring by Actual Weight

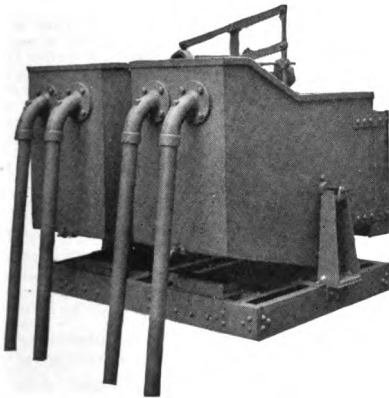
WATER—OIL—SUGAR—JUICE—SPIRITS—  
PETROLEUM—AMMONIA—BRINE—  
CHEMICALS AND LIQUIDS OF ALL  
DESCRIPTIONS

Simple: Accurate: Reliable

NOT AFFECTED BY TEMPERATURE  
PRACTICALLY NO WEARING PARTS

The Pre-eminent Meter  
for  
Power House Service

Types: At the present time these



machines are made in ten standard sizes with charge capacities (*i. e.*, contents of single bucket) from 10 lbs. in the smallest No. 1 machine up to 2,000 lbs. The nor-

mal capacities per hour in the table are based on a conservative speed of one discharge (one tilt of the bucket) per minute.

The Type "A" machines have for inlet mechanism a three-way cylindrical valve and are suitable for all liquids with the exception of very sticky ones for which Type "C" machines having as inlet an oscillating trough, called deflector, should be preferred.

For measuring hot water or liquids emanating obnoxious gases the machines must be enclosed in a casing Type "AE" and Type "CE" machines.

The Type "B" machines in which the measuring buckets tilt under a reduced feeding stream make it possible to obtain, in a simple way, the highest degree of accuracy in the automatic weighing of liquids.

**Durability:** All parts being easily accessible can be cleaned whenever necessary, even during operation. The measuring tanks and other parts in contact with liquid can be made of the best resisting material and are not otherwise subjected to serious wear.

**Accuracy:** These machines being a modified form of a one-lever balance with a single pair of knife edges, when once in operation, being free from human errors, obviously give in industrial practice an accuracy far superior to that obtained by hand weighing on commercial scales. Type "A" and Type "C" machines have an accuracy of less than one-half of 1 per cent., while Type "B" machines possess a correspondingly higher accuracy.

## LEINERT AUTOMATIC LIQUID SCALES TYPE "A"

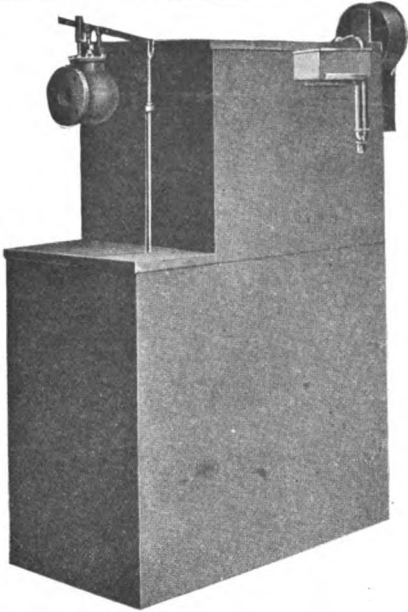
SIZE NO.	APPROXIMATE NORM. CAPACITIES: Water, Petroleum, Milk, Etc.		LBS. PER DIS-CHARGE CAPACITY OF TANK	SIZE OF INLET PIPE	APPROXIMATE DIMENSIONS			
	U. S. Gals. per Min.	Lbs. per Hour			Length	Width	Height	Base to End Siphon
1	1.1	600	10	1/2"	1'-6"	1'-6"	1'-1"	0'-8"
3	7 1/2	3600	60	1"	2'-5 1/2"	2'-5"	1'-9 1/4"	0'-9"
4	12	6000	100	1 1/2"	2'-10"	2'-9"	2'-3"	0'-9 1/2"
5	30	15000	250	2"	3'-9"	3'-8 1/2"	2'-10 1/2"	1'-3"
6	60	30000	500	2 1/2"	4'-7"	4'-6"	3'-5"	1'-5"
8	120	60000	1000	3"	6'-0"	5'-8"	4'-0"	1'-8"
9	180	90000	1500	3 1/2"	7'-0"	6'-7"	4'-7"	1'-9"
10	240	120000	2000	4 1/2"	7'-9"	7'-4"	5'-2"	2'-4"

# WILLCOX ENGINEERING CO.

SAGINAW, MICHIGAN, U. S. A.

Manufacturers of Water Weighers

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## WILLCOX AUTOMATIC WATER WEIGHER (Patented):

*Rectangular type with storage tank forming the base of the weigher, and automatic control of inlet supply to the weigher.*

**Service:** Takes water from any source, such as a feed-water heater, tank, pump or hydrant, at any rate of flow or at varying rates, and delivers it intermittently in accurately weighed unit charges.

Weighs hot feed-water from an open heater, cold water from a hydrant, water of condensation from vacuum pans or heating systems, also chemicals, caustic solutions, volatile oils, sugar juices, etc.

**Operation:** The charge is weighed by a liquid column of fixed height, through the medium of an air balance. The unit charge is dumped automatically by the sudden release of the entrapped air—an extremely accurate and reliable method of balancing.

**All Parts Accessible:** The weigher is constructed so that every part is easily accessible and the bell float and other operating parts can be taken out of the machine and replaced without disturbing the setting of the machine, or breaking any packed joints. The machine is so constructed that its entire cycle of operations can be seen while the machine is working. Dirt and scale within any reasonable amount will not affect its accuracy or its operation, and it can be easily cleaned.

**Only One Moving Part:** There is practically no friction, there being only one moving part in the machine, namely, the bell float with its attached stand pipe. This part has a floating movement up and down of about one inch at each weighing.

**Accuracy:** Maximum per cent. of inaccuracy of the weigher at all loads from one-tenth of its

maximum capacity up to said maximum, one per cent. by weight; the average weight of any ten consecutive unit charges being compared with the average weight of any other ten unit charges.

**Capacities:** Made in capacities from five thousand pounds to five hundred thousand pounds per hour to suit various requirements; portable weighers for evaporative and condensing tests; and power-plant sets for permanent installation.

**Storage Tank and Float Control:** Willcox Engineering Co. will furnish a storage tank, forming the base of the weigher as illustrated, and fitted with a balance-pressure valve on the inlet to the weigher, the balance-valve being controlled by a float in the storage tank, thereby automatically regulating the frequency of the weighings according to the varying demands of the plant, and automatically maintaining an approximately uniform level in the storage tank. Where the weighed charges can be delivered from the weigher direct into a sump or tank already available at the plant, the storage tank illustrated can be omitted. Weigher can be furnished with or without the storage tank and balance-valve as desired.

**Diagram Recorder:** Draws a diagram showing at a glance the variations in rate of supply during a test. A valuable check for boiler trials and condensation tests. The Diagram Recorder Attachment can be furnished for any size or style of Weigher, and with either a twelve-hour or a twenty-four-hour clock, and arranged to operate either by mechanical connection to the Weigher as illustrated, or electrically, at a distance from the Weigher, as desired. Diagram Recorders are furnished on special order only.

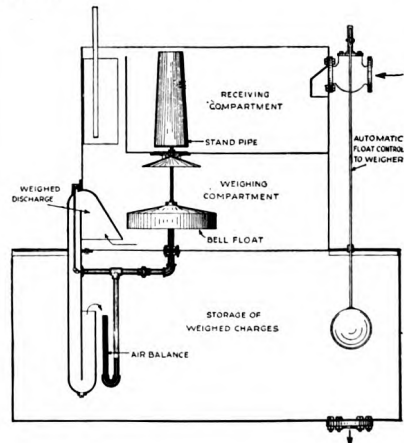
## CONSTRUCTION:

**Weigher Shell:** Built of tank steel with seams welded.

**Fittings:** Cast brass and vanadium steel; bell float and stand pipe made of heavy sheet brass.

**Register:** White dial indicating through a glass cover. Each weighed charge is indicated as delivered.

**Heavy Steel Inlet Screen:** On inlet to weigher to prevent entrance of pieces of scale or foreign matter.





# NATIONAL METER COMPANY

Established 1870

299 BROADWAY

NEW YORK CITY

Manufacturers of Water Meters and Gas Engines

## BRANCH OFFICES:

CHICAGO, 2626 So. Park Ave.  
PITTSBURGH, 4 Smithfield St.

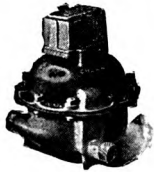
BOSTON, 159 Franklin St.  
ATLANTA, 200 Ivy St.  
WINNIPEG, MANITOBA, 111 Ethelbert St.

CINCINNATI, 224 East 4th St.  
SAN FRANCISCO, 141 New Montgomery St.  
LONDON, 25 Victoria St.

No matter what your conditions may be, we can offer you the **BEST METER FOR YOUR SERVICE.**

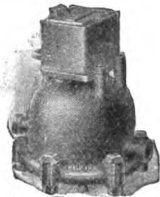
### THE CROWN METER:

A positive displacement water meter of the rotary piston type. This meter has been made and sold by us for nearly forty years. It is substantial, durable and accurate. In sizes from  $\frac{5}{8}$ " to 6".



### THE EMPIRE METER:

A positive displacement water meter of the oscillating piston type. It is the most accurate, durable and generally satisfactory meter manufactured. Owing to the simple construction of its measuring chamber the accuracy of this meter can be maintained indefinitely at a minimum cost. The Empire meter is also manufactured for measuring oil, hot or cold—cane juice—brine, vinegar, liquid soap, wine, etc. Made in sizes from  $\frac{5}{8}$ " to 6".



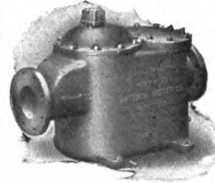
### THE NASH METER:

A positive displacement water meter of the disc type. This meter has been on the market for over twenty-five years. The reinforced disc, frost-proof feature and straight reading register are a few of its many superior advantages. Made in sizes from  $\frac{5}{8}$ " to 6".



### THE GEM METER:

A water meter of the velocity or current type and has been made by us since 1870. It is intended for service when a large and rapid delivery of water is of special advantage. Made in sizes from 2" to 12".



### THE PREMIER METER:



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A water meter constructed of a Venturi Tube and a by-pass on which an accurate, positive displacement meter is installed. This meter is intended to measure the complete supply of a city or other large service. The Premier is made in sizes from 8" to 48".

### THE EMPIRE COMPOUND METER:

A water meter constructed by combining our Empire and Gem meters. It will measure with great accuracy large and small flows, and will operate most satisfactorily under greatly varying conditions. The Empire section is always open. The Gem section is controlled by a check valve which opens automatically when called upon to measure a stream larger than the capacity of the Empire. Made in sizes from 2" to 12".



# NEPTUNE METER COMPANY

50 EAST 42ND STREET, NEW YORK CITY

Trident Water Meters—The Weber Subterranean Pump

## BRANCH OFFICES

ATLANTA  
BOSTON  
CHICAGO  
CINCINNATI  
DENVER

LOS ANGELES  
PORTLAND  
SALT LAKE CITY  
SAN FRANCISCO  
SEATTLE

SPOKANE  
VANCOUVER, B. C.  
LONDON, ENGLAND  
PARIS, FRANCE  
KOBE, JAPAN

### TRIDENT PRE-EMINENCE:

More than 1,800,000 Trident meters in service indicate the supremacy of the Trident.

This supremacy is the result of one factor—the *worth* of the Trident.

### FOR EVERY CLASS OF SERVICE:

There is a Trident Meter for every class of service.

Special meters designed for special requirements.

*Write us.*

232



Trident  
Breakable Bottom



Trident Split Case



Trident Crest



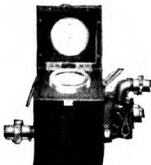
Trident Style 3



Trident Victor



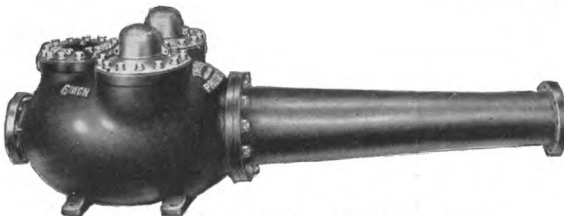
Trident Compound



Trident  
Portable Test



Trident  
Water Cart



Trident Protectus—A Fire-Service Meter



Trident  
Vertical  
Crest

## PITTSBURGH METER COMPANY

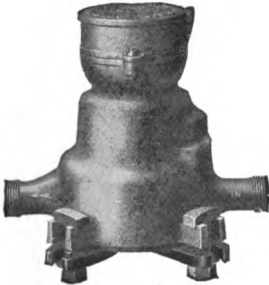
GENERAL OFFICE AND WORKS: EAST PITTSBURGH, PA.

NEW YORK 149 Broadway CHICAGO 5 S. Wabash Ave. KANSAS CITY 6 W. 10th St. COLUMBIA, S. C. 1433 Main St. LOS ANGELES Union Oil Bldg. SEATTLE 802 Madison St.

**Manufacturers of "Ironclad" Cast Iron Dry Gas Meters, Positive and Proportional Gas Meters, Meter Provers, and Keystone, Arctic, Keystone-Compound, Eureka and Utility Water Meters. Also Meters for Measuring Oil, Gasoline and Hot Water**

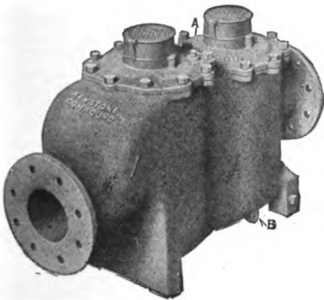
### WATER METERS:

Meters for the measurement of hot or cold water, oil, gasoline and all other liquids.



Arctic Water Meter

"Arctic" Water Meters for cold climates, "Keystone" Water Meters for mild climates. These are Disc-Type Meters. In the Current or Inferential Types we manufacture the "Eureka" Meter, and in the Compound Type the "Keystone-Compound" and the "Utility" Meters.



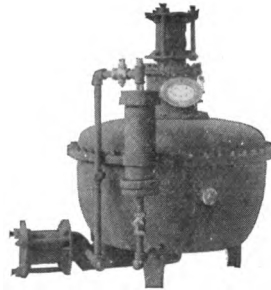
Keystone-Compound Water Meter

Among these various types may be found meters adapted to every class and condition of service—domestic, commercial and industrial.

### GAS METERS:

Meters for the measurement of natural and artificial gas of all kinds, including that used in the arts, as well as for com-

bustion, are manufactured in both wet and dry types.



Westinghouse Positive Gas Meter

Westinghouse Gas Meters, positive and proportional, are particularly adapted for gases at high or low pressures, in large 233 or small volumes.

Their all-metal construction gives them great durability under all conditions of severe service.



"Ironclad" Dry Gas Meter

The "Ironclad" Cast-iron Dry Gas Meter is designed for use on domestic and commercial service furnishing natural or artificial gas.

Its simplicity of construction, combined with the material used, affords an extremely low maintenance cost in conjunction with a high degree of accuracy.

We also manufacture apparatus for proving water and gas meters.

# BUILDERS IRON FOUNDRY

PROVIDENCE, R. I.

Venturi Meters for Cold Water, Hot Water, Brine, Chemical Solutions, Sewage, Steam, Gas and Air; Globe Special Castings for Water Works; Grinding Machinery; Polishing Machinery

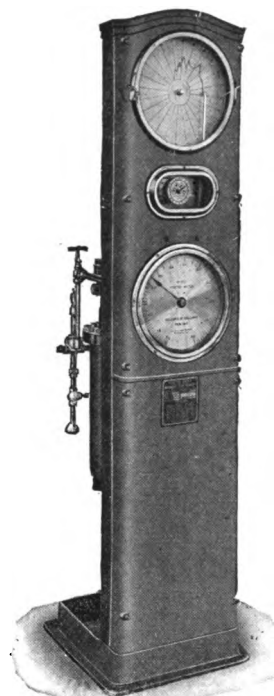
## THE VENTURI METER:

The Venturi Meter consists of a Venturi Meter Tube and a Register or Recording Instrument. The Meter Tube is set in the pipe line similar to a section of pipe, and the Instrument, which is connected to the Meter Tube by two small pipes, can be set in any convenient space where the readings may be easily observed. Bulletin No. 90, "Measuring Water," is of engineering and historical interest.

## THE VENTURI COLD WATER METER:

This is a type which may be used in connection with Gravity Mains, Pump Discharge Lines, Filtration Plants, Sewage Disposal Systems, Hydraulic Turbines, Refrigerating Plants, etc. Bulletin No. 84 contains descriptions, illustrations, tables of capacities and other data.

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Type M Register-Indicator-Recorder

## STANDARD VENTURI METER TUBES AND CORRESPONDING MEASURING CAPACITIES

Inches Diameter of Pipe	Catalog Number	Length of Meter Tube	Pounds per Hour Maximum	Gallons per Minute Maximum	Gallons per 24 Hours Maximum
2	25 $\frac{5}{8}$	1'-11 $\frac{1}{2}$ "	17600	35	51000
	25 $\frac{1}{2}$	1'-10 $\frac{1}{2}$ "	25400	55	73000
	21	1'-7"	45100	90	130000
3	31	2'-11"	45100	90	130000
	31 $\frac{1}{4}$	2'-7 $\frac{3}{4}$ "	70400	140	203000
	31 $\frac{1}{2}$	2'-4 $\frac{1}{2}$ "	102000	205	293000
4	41 $\frac{1}{4}$	4'-3 $\frac{3}{4}$ "	70400	140	203000
	41 $\frac{3}{8}$	3'-10 $\frac{1}{8}$ "	119000	240	343000
	42	3'-6"	181000	360	520000
5	51 $\frac{5}{8}$	5'-1 $\frac{3}{8}$ "	119000	240	343000
	52	4'-8 $\frac{1}{2}$ "	181000	360	520000
	52 $\frac{1}{2}$	4'-2"	282000	565	813000
6	62	5'-11"	181000	360	520000
	62 $\frac{1}{4}$	5'-4 $\frac{1}{2}$ "	282000	565	813000
	63	4'-10"	406000	810	1170000
12	124	11'-0"	722000	1440	2080000
	125	9'-11"	1129000	2260	3250000
	126	8'-10"	1626000	3250	4680000
24	248	21'-2"	...	5780	8320000
	2410	19'-0"	...	9020	13000000
	2412	16'-10"	...	13000	18720000
36	3612	31'-4"	...	13000	18720000
	3615	28'-1"	...	20300	29250000
	3618	24'-10"	...	29300	42120000
48	4816	41'-6"	...	23100	33280000
	4820	37'-2"	...	36100	52000000
	4824	32'-10"	...	52000	74880000

Dimensions of intermediate and larger sizes on application.



The Venturi Tube

## THE VENTURI HOT WATER METER

The VENTURI is admirably adapted to the measurement of hot boiler feed water, hot water from condensers, hot circulating water for heating systems, etc. The entire absence of mechanism or projections within the Venturi Tube, which is the only portion of the METER through which the water flows, prevents scaring, warping and clogging. Bulletin No. 92 describes fully. ■

## THE VENTURI AIR, STEAM AND GAS METER:

For the measurement of Air, Gas and Steam the Venturi offers distinct advantages, among which are Simplicity, Compactness, Adaptability to Changes in Measuring Capacity, and Low Cost. Bulletin No. 86 describes the Meter for Air and Gas and Bulletin No. 79 for Steam.

Any or all of the above Bulletins will be mailed on request.

# BAILEY METER COMPANY

2009 E. 46TH St., CLEVELAND, OHIO

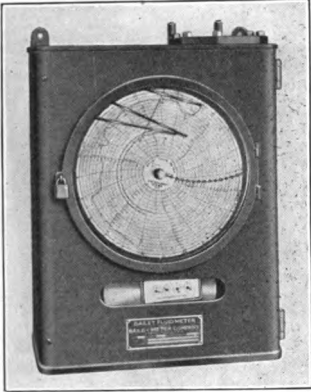
BRANCH OFFICE

6 OLIVER St., BOSTON, MASS.

**Manufacturers of Recording Meters and Instruments**

## BAILEY FLUID METERS:

Are the most practical and accurate meters for recording and integrating the flow of steam to turbines, engines, heating systems, general mill use; low pressure steam, exhaust, and in fact for all purposes. Equally well adapted to measure the flow of water, air, gases and other fluids, under practically all conditions of pressure, temperature and capacity.



There are but two moving parts to this meter and they are not subjected to the direct action of the steam, hot gases or other fluid being metered. The meter is operated by a pressure difference which is produced by the fluid flowing through an orifice placed between a pair of flanges in the pipe line.

Bailey Fluid Meter Type C2 Recording and Integrating Flow, also Recording Pressure and Temperature illustrated above.

## BAILEY BOILER METER:

This meter records Steam Flow, Air Flow and Flue Gas Temperature all on the same chart. It may also be provided with fire box draft indicator, wind box pressure recorder or other supplementary records. It also may be provided with integrator giving the total evaporation from the boiler in thousand pounds of steam, from which the actual evaporation of useful steam delivered to the header per pound of coal is determined.

The most important feature of this meter lies in the ratio between the Air Flow and Steam Flow. Air is a fuel just

as much as coal, and a certain evaporation per pound of air should be obtained. When this condition exists the two pens and records show the same reading. When there is an excess of air, the Air Flow reading is greater than the Steam Flow. A deficiency of air resulting in loss due to unburned gases is shown by the Air Flow reading being less than the Steam Flow.

Flue gas temperature recorded on the same chart is a positive check against dirty tubes and leaky baffles.

## BAILEY WEIR METER:

Records and integrates flow of water or other liquids through V-Notch or rectangular weirs. For feed water, hot well discharge, etc., at or near atmospheric pressure.

## BAILEY GAS METER:

Records the rate of flow of low pressure gas or air at high or low velocities, with  $4\frac{1}{4}$  inch pen motion on 12 inch chart and integrates total flow reading directly in cubic feet. It can be equipped to record pressure or temperature or both on the same chart. Net pressure loss due to meter  $\frac{1}{2}$  inch of water.

The orifice can be easily inserted in some existing flange and requires no alterations in the piping. A change of orifice will give a change in capacity at slight cost. The recorder may be connected to two or more pipes so that records may be taken at will. It can be conveniently moved so that it is available for tests and temporary installations.

These meters are now in use measuring coke oven gas at a number of locations and service of over a year has demonstrated their reliability.

The meter is low in first cost and maintenance and operating costs are negligible.

## OTHER TYPES:

Many other types of recording meters for special purposes such as specific gravity of liquids or gases, relation between the flow of two fluids or gases, differential temperatures and rate of flow for economizers and hot water heating systems.

*Bulletins describing the complete line of Bailey Recording Meters will be sent free upon request.*



## REPUBLIC FLOW METERS CO.

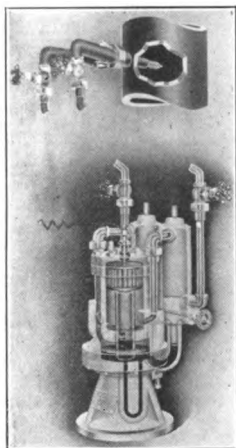
565 W. WASHINGTON BLVD., CHICAGO

Manufacturers of Meters for Steam, Water, Air or Gas; also Hydrometers

### THE REPUBLIC FLOW METER:

Accurately measures the fluid passing through a pipe to which the instrument is attached.

The illustration shows a complete installation. It comprises a regular transformer producing an individual low voltage circuit which includes the instruments on the panel, the meter body, and is completed through the ground.



A Pitot tube, or orifice plate, inserted into the pipe where the flow is to be measured, transmits the pressure difference created by the flow to a mercury column in the meter body. The rise and fall of the mercury column is made to engage and disengage suitable conductors regulating the amount of current flowing through the circuit.

Accordingly, the exact electrical energy measured by the Flow Integrator is the exact equivalent of the total amount of fluid passing through the pipe, and the

instantaneous flow of current shown by the Indicator and Recorder is equivalent to the instantaneous flow of fluid through the pipe.

### PRINCIPAL ADVANTAGES:

1. The Action is performed by means of an electric current, thus avoiding all uncertain mechanical movements, such as floats, cams, levers and gears. There are no moving parts in the meter body.
2. The accuracy of highly refined electrical instruments, combined with the accuracy of the Pitot tube, insures the accurate measurement of the flow.
3. The instruments for indicating, integrating and recording the flow can be arranged to meet all possible conditions, because they can be either separated, or combined, or duplicated, and can be placed at any desired distance from the pipe line.

### READING INSTRUMENTS:

The indicator is ten inches in diameter and may be calibrated to read directly in boiler horse power, thousands of pounds per hour or other suitable units of flow.

The Recorder is twelve inches in diameter and is equipped with a ten-inch chart graduated from 0-100.

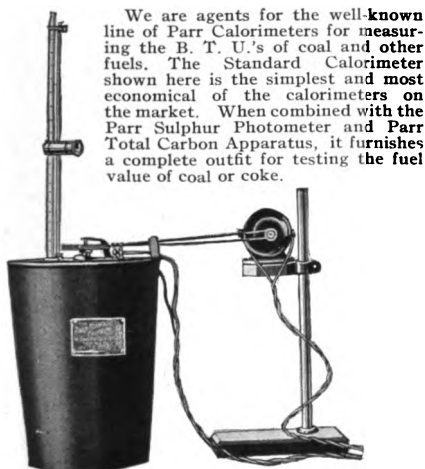
The Integrator is provided with four dials and is equipped with a glass cover. It is simple and rugged in design and will accurately total the flow over any given period of time.

## CENTRAL SCIENTIFIC COMPANY

460 EAST OHIO STREET, CHICAGO, U. S. A.

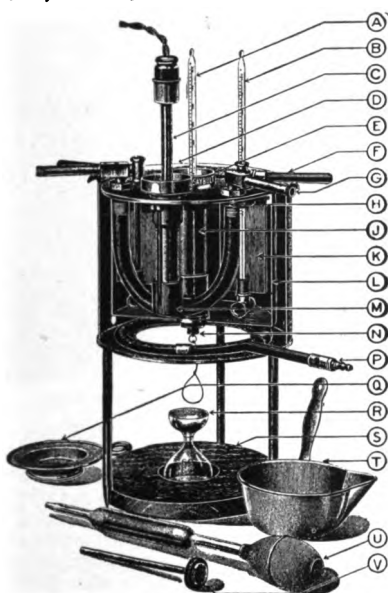
**Manufacturers of and Dealers in Measuring and Testing Instruments of Every Kind Including Physical and Chemical Apparatus for Every Purpose**

### FUEL TESTING APPARATUS:



We are agents for the well-known line of Parr Calorimeters for measuring the B. T. U.'s of coal and other fuels. The Standard Calorimeter shown here is the simplest and most economical of the calorimeters on the market. When combined with the Parr Sulphur Photometer and Parr Total Carbon Apparatus, it furnishes a complete outfit for testing the fuel value of coal or coke.

For full description send for Bulletin 730.



### OIL TESTING APPARATUS:

We handle a complete line including Centrifuges, Distilling Apparatus, Flash Testers, Hydrometers, Thermometers, Viscosimeters, Wax

Testers and Wantage Rods.

Send for Reprint 90 for complete line.

### HIGH VACUUM PUMPS:

We are manufacturers of the Cenco-Nelson line of high vacuum pumps for producing vacuum down to 0.05 mm. They are small (7 in. high), compact, portable, easily operated, require no backing pump and are capable of continued service over long periods of time without attention.



For description send for Bulletin 450.

### TACHOMETERS:

We are sole agents to the scientific trade for the VAN SICKLEN CHRONOMETRIC TACHOMETER, the tachometer timed by an Elgin watch.

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This is the first genuine precision tachometer offered to American scientists.

For full description send for Bulletin 810.

In addition to the above specialties, we carry in stock everything for the testing laboratory. Our line includes *Electrical Measuring Instruments, Gas Testing Apparatus, Hardness Testers, Combustion Appliances (CO<sub>2</sub> Indicators, Draft Gages, Etc.), Pyrometers, Measuring Instruments (Vernier and Micrometer Calipers, Speed Indicators, Etc.), and Metallographic Apparatus.*

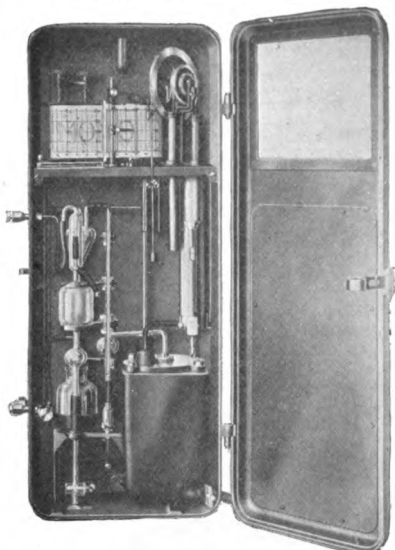
**CATALOGS SENT ON APPLICATION**

## F. D. HARGER CO.

ELLICOTT SQUARE, BUFFALO, N. Y.

Manufacturers of Mono CO<sub>2</sub>, CO, O<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub> Automatic Recorders

### MONO CO<sub>2</sub> RECORDER:



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Fig. 1—MONO Combustion Recorder  
Type "A-B"

We present above the simplest and most accurate Combustion Recorder MONO. It is driven by compressed air or water, the pressure raising a mercury column in a 100 cc. burette and releasing same, thus drawing in a charge of gas, forcing same through the caustic potash and measuring it after absorption in a gasometer. The difference by volume is recorded on a wide sixty days' chart. The installation consists of fine copper tubing, thus there is no "lag" and no water or steam injector is required.

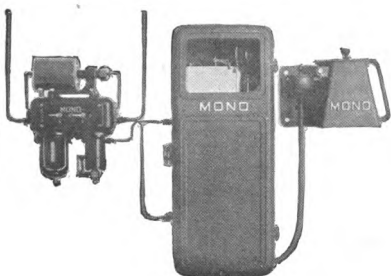


Fig. 2—MONO Monoxide Recorder

Two filters, moisture-temperature regulator and filling device are part of the apparatus.

### MONO CO RECORDER:

(See also Fig. 5.) For the first time in the history of recording instruments, we are now offering to cement plants, chemical works and producer gas plants, as well as for boiler room use, our MONO Monoxide Supplement, type "K," which is an auxiliary apparatus attached to the CO<sub>2</sub> Recorder, thus permitting of recording CO<sub>2</sub> as well as CO on one chart. Very suitable also for SO<sub>2</sub>.

### MONO O<sub>2</sub> RECORDER:

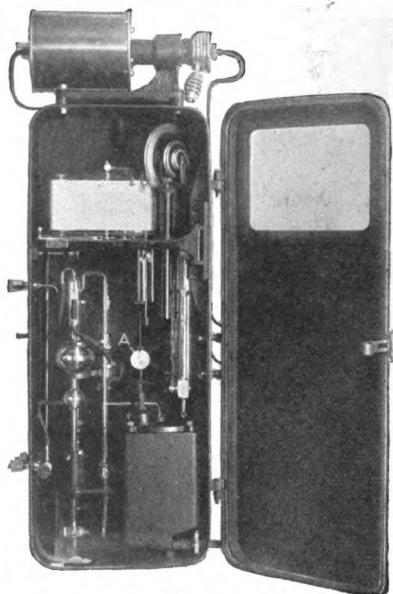


Fig. 3—MONO Oxygen Recorder

Another auxiliary, type "S," can be attached to the CO<sub>2</sub> Recorder MONO, making the apparatus suitable by changing valve "A" also for analysis of Oxygen, thus the CO<sub>2</sub>, CO, O<sub>2</sub> combination is formed. A very desirable apparatus for lime kilns and hundreds of industrial purposes. The oxygen is absorbed in a special oxygen cartridge under high heat electrically generated. We draw special attention to the fact that almost any range between 0 and 100% purity can be supplied.



## F. D. HARGER CO.

### MONO H<sub>2</sub> RECORDER:

After years of experimenting with devices for recording percentages of hydrogen and many failures, we take pride in announcing that such apparatus has now been designed, and as it has been found thoroughly practical, we have placed on the market our type "V." The instrument resembles in many ways the MONO Oxygen Recorder inasmuch as here also a special cartridge is used which under high heat, generated in an electric oven, condenses the amount of H<sub>2</sub> to water, thus contracts the original volume and this contraction is recorded. This auxiliary, too, may be connected with CO<sub>2</sub> and CO types.

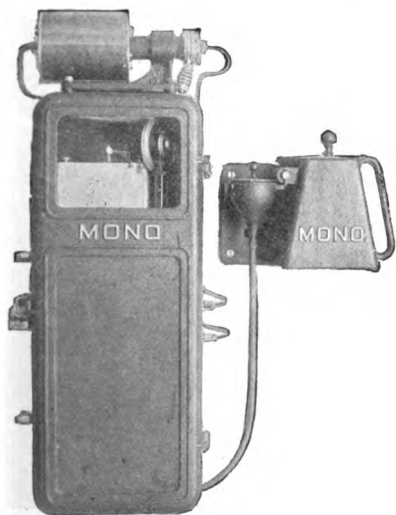


Fig. 4—MONO Hydrogen Recorder

### CO AUXILIARY APPARATUS:

We have only briefly indicated in Fig. 2 the purpose of the combination of types "A-B" with "K" as well as its application. Figure 5 gives a clear picture of this auxiliary apparatus. The gas passes first into a filter containing caustic potash. Here CO<sub>2</sub> is filtered out but not measured. The remainder, oxygen, hydrogen, monoxide, nitrogen, etc., passes into an electrically heated oven on top where this mixture is burned to CO<sub>2</sub> again and as one volume of CO<sub>2</sub> equals one volume of CO, the newly generated CO<sub>2</sub> gas is passed into the CO<sub>2</sub> Recorder and is recorded as carbon monoxide.

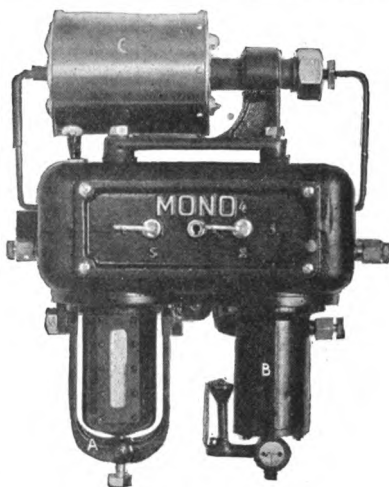


Fig. 5—Monoxide Auxiliary, type "K"

### INSTALLATION OF MONO CO<sub>2</sub> RECORDER:

As previously said, the installation is very simple but care must be taken that the gas lines are air-tight. This photograph shows the instrument with a 5-way cock for connection to five gas sources, moisture regulator, filling device and filter for the motive power.

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We shall be glad to describe the actions of our instruments. *Ask for particulars.*

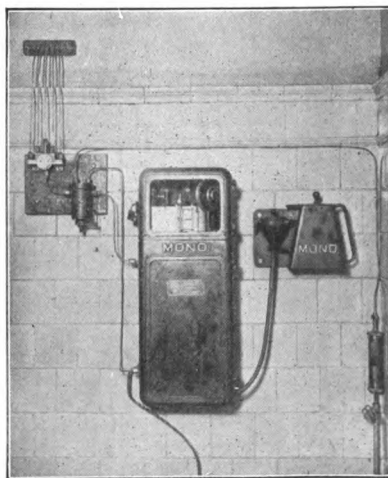
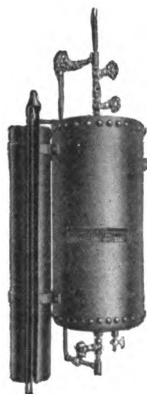


Fig. 6—MONO Installation

# PRECISION INSTRUMENT CO.

DETROIT, MICHIGAN

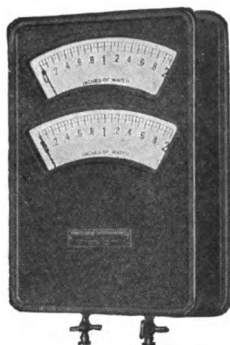


**FLUE GAS ANALYZER:**

50 c.c. Orsats graduated to  $\frac{1}{5}$  per cent.  
100 c.c. Orsats graduated  $\frac{1}{10}$  to per cent.

Made with any number of pipettes desired.  
Our Orsats have half the weight and one-quarter the volume of the ordinary type.

240



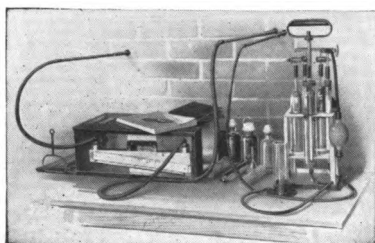
**"2 IN 1" DRAFT GAUGE:**

(Indicating)

For natural draft boilers. Diaphragm type of gauge. Also used on economizers and waste heat boilers. Guaranteed accurate at all points of scale.

**EFFICIENCY KIT:**

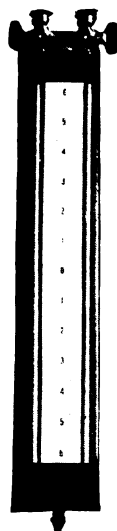
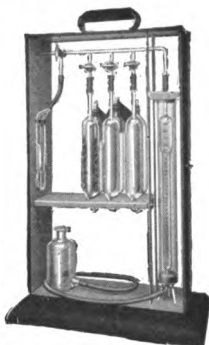
A neat metal case for carrying the instruments forms part of kit.



We manufacture:

## GAS COLLECTORS

- Chemical Glassware
- Gravimeters
- Gas Test Meters
- Coal Calorimeters
- Air Speed Indicators
- Mercury Column Gauges, etc.

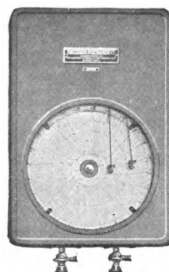
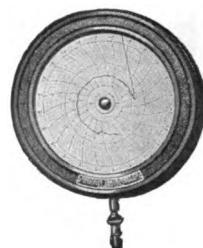


**U-TUBE GAUGE:**

Made in numerous types and all lengths. Backs of asbestos wood that cannot warp and are not affected by heat or moisture. Heads cut from solid steel blocks. Provision made for filling, draining and cleaning. Neat in appearance, rugged in construction.

**RECORDING GAUGE:**  
(Pressure or Draft)

Guaranteed accurate at all points of scale.

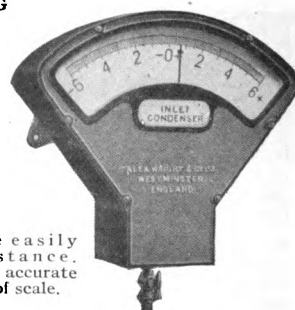


**2 IN 1 DRAFT GAUGE:**  
(Recording)

Gives the superintendent or chief engineer a permanent record of draft conditions. Diaphragm type of gauge. Guaranteed accurate at all points of scale.

**INDICATING GAUGE:**

(Pressure or Draft)



Large scale easily read at a distance. Guaranteed accurate at all points of scale.

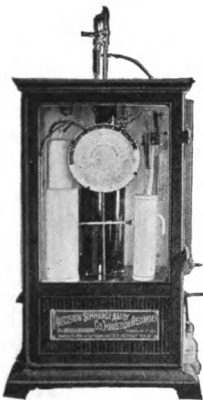
Write for Catalog.

Our Service Department is for You.

All Instruments Fully Covered by the Famous Precision Guarantee.

# PRECISION INSTRUMENT COMPANY

DETROIT, MICHIGAN



## CO<sub>2</sub> RECORDER: (24 Hour Chart)

We make recorders to work against a vacuum of 18 inches of water.

Standard range 0-20 per cent.

Other ranges up to 100 per cent.

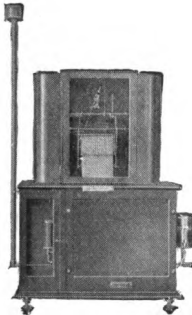
Accurate to  $\frac{1}{2}$  of 1 per cent.

We also make 60-day tape combined CO<sub>2</sub> and draft recorders.

## RECORDING GAS CALORIMETER:

Gives continuous 60-day record of calorific value of gas.

Compensates for variations in pressure, volume and specific gravity.



## COMBINED INDICATING AND RECORDING GAUGE:

(Pressure or Draft)

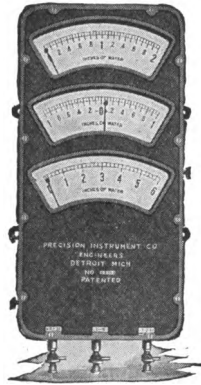
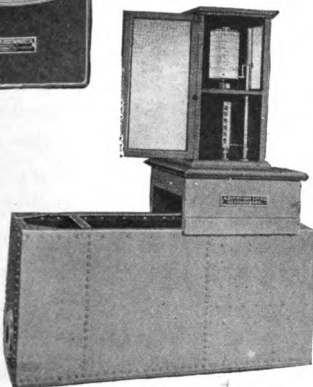
Has an indicating scale for the operating man and a 60-day tape recording chart giving a permanent record.



## WATER METER: (Yorke Weir)

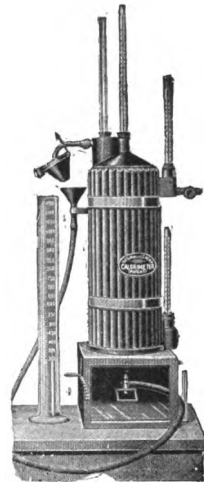
Indicating, recording.

Accurate to 1 per cent.



## "3 IN 1" DRAFT GAUGE:

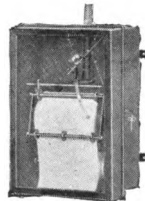
For forced draft, stoker fired boilers. Gives pressure in wind box, draft over fuel bed, and draft at last pass. Length 20  $\frac{1}{2}$  inches. Diaphragm type of gauge. Guaranteed to be accurate at all points of scale.



241

## GAS CALORIMETER:

Furnished with gas test meter, pressure regulator, graduates, and thermometers complete. Simplest, most accurate, and most convenient calorimeter manufactured.



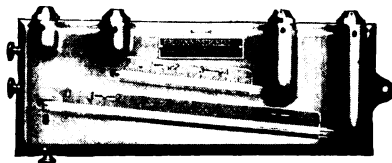
## TAPE RECORDING GAUGE:

(Pressure or Draft)

Gives record on 60-day chart. All Precision gauges are equipped with patented dead heat pen movement and are guaranteed to be accurate at all points of scale.

## DRAFT GAUGE:

(Double)



Sliding scales and leveling device for micrometer adjustment.

Write for Catalog.

Our Service Department is for You.

All Instruments Fully Covered by the Famous Precision Guarantee.



## UEHLING INSTRUMENT COMPANY

2011 EMPIRE BUILDING, NEW YORK CITY

Manufacturing Engineers—Combustion Economists

### UEHLING CO<sub>2</sub> RECORDERS:

Uehling CO<sub>2</sub> Equipment provides the means for obtaining and maintaining high boiler efficiency. Such equipment consists of the **Instrument Proper**, which can be located in the engine-room or any other convenient part of the plant, the **Recording Gauge** which can be

242 located in the office of the Chief Engineer or Superintendent, and the **Auxiliary CO<sub>2</sub> Indicator** which can be located at the boiler front so that the fireman can be held responsible for the fuel wasted up the chimney, just the same as he is held responsible for an even steam pressure by means of the steam gauge.

The per cent of CO<sub>2</sub> in the products of combustion is a true index of the excess air used, therefore the lower the per cent of CO<sub>2</sub> the greater the volume of products of combustion per pound of fuel consumed, and since all gases leave the boiler at stack temperature the per cent of CO<sub>2</sub> in the products of combustion bears a direct relation to the sensible heat wasted up the chimney.



UEHLING  
CO<sub>2</sub> RECORDER  
No Chemical  
Solutions

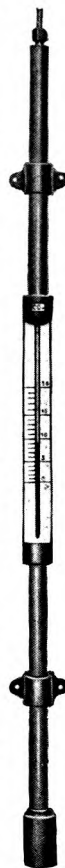
### OTHER UEHLING INSTRUMENTS:

- Uehling Draft Recording Gauge.
- Uehling Differential Draft Recorder.
- Uehling Draft Indicator.
- Uehling Differential Draft Indicator.
- Uehling Draft Analyzer.
- Uehling Light Pressure and Vacuum Recorder.
- Uehling Vacuum Recorder.
- Uehling Combined Barometer and Vacuum Recorder.
- Uehling Absolute Pressure Indicator.
- Uehling Pneumatic Pyrometer.
- Uehling Revolution Recorder.

The distinctive features of Uehling Recording Instruments are *Simplicity, Accuracy and Reliability*. They are based on the *hydrostatic principle*, by the application of which all springs, levers and joint movements are avoided.

In addition to these important advantages, the hydrostatic principle permits of making the scale open, between the limits where the readings are important, and narrow, where they are unimportant, or eliminating that part of the scale altogether which is of no use, thus utilizing the whole width of the chart for important readings.

Send for Catalogs and booklet "*Combustion and the Cost of Power.*"



CO<sub>2</sub>  
Indicator  
for Boiler  
Front

## THE ASHTON VALVE COMPANY

161 FIRST ST., CAMBRIDGE, BOSTON, MASS.

### BRANCH OFFICES

137 Liberty St., NEW YORK

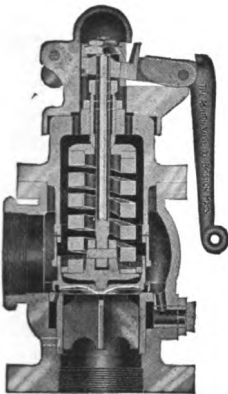
318 W. Washington St., CHICAGO, ILL.

503 Mission St., SAN FRANCISCO, CAL.

**Manufacturers of Pop Safety Valves, Pressure and Vacuum Gages and Kindred Engineering Specialties**

### THE ASHTON IMPROVED POP SAFETY VALVE:

Embodies the latest improvements in the state of the Art and has been the acknowledged Quality Standard among Engineers for the past 48 years. When of proper size Ashton Valves give prompt and full relief to a boiler and prevent any accumulation of pressure above the point at which they are set. They are reliable and sensitive in action, and operate with a uniform and only moderate blow back, thereby showing greatest economy in both fuel and steam. They are solid in construction with all working parts of high grade material insuring most durable service and lowest cost of maintenance.

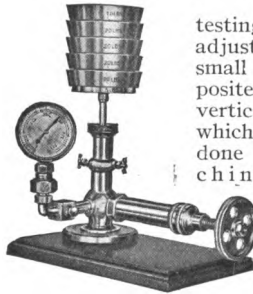


Ashton Pop Safety Valves are made to give any desired capacity of relief, and when so specified are furnished to fully comply with the requirements of the A. S. M. E. Boiler Code, as well as any special state or local regulations.

### THE ASHTON IMPROVED DEAD WEIGHT PRESSURE GAGE TESTER:

Offers the most modern method for obtaining an accurate test of pressure gages by means of weights. It is convenient in form and readily portable, being packed in two separate cases with locked covers and furnished with substantial handles.

The style illustrated with double area piston requires only one-fourth the usual number of weights and is suitable for high pressure testing up to a maximum of either 500 or 1000 lbs. per sq. in. It is also adaptable for low pressure



testing by a simple adjustment of the two small valves on opposite sides of the vertical cylinder, which can readily be done while the machine is in use.

Single Area Testers are furnished for pressures up to 300 lbs.

### THE ASHTON IMPROVED PRESSURE AND VACUUM GAGES:

Are made for all kinds of service in either plain registering or recording styles, and of either single or double spring construction. The springs are of best quality seamless drawn tubing, the movements non-corrosive with German Silver pinions and arbors, and the dials accurately graduated.

243



Ashton Recording Gages as illustrated give a daily record on paper charts showing all pressure variations both day and night giving the time and length of every change, thus assuring careful firing, steady pressure, and highest efficiency and economy. Each gage is furnished with one year's supply of charts, ink and pen filler.

Our finely illustrated and descriptive book of 120 pages tells all about the full line of Ashton Specialties. Write for it NOW.



## CROSBY STEAM GAGE & VALVE CO.

EXECUTIVE OFFICES

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STORES: BOSTON, 38 Central Street

NEW YORK, Hudson Terminal Bldg., Dey Street

CHICAGO, 180 No. Market Street

LONDON, ENG., 147 Queen Victoria Street

**Manufacturers of Standard Steam Appliances**

We present for the consideration of Mechanical Engineers certain instruments of our manufacture which we believe are scientifically and mechanically the best of their kind yet produced.

### GAGES:



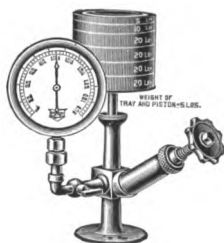
Crosby Pressure Gage

For any and all purposes.

### RECORDING GAGES:

Daily, weekly or continuous records for Pressure, Vacuum, Hydraulic, etc.

### GAGE TESTING INSTRUMENT:



Crosby Pressure Gage Tester

Made on scientific principles and is mathematically correct.

### REVOLUTION COUNTERS:



Crosby Revolution Counter

Positive in action, reliable, durable.

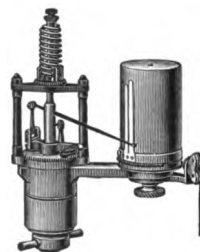
### RECORDING COUNTERS:

An instrument of wide application and of the greatest usefulness to engineers.

### INDICATORS:

Steam, Gas, Hydraulic, etc.

As perfect in workmanship and operation as human skill can devise.



Crosby New Indicator

Also Lanza Continuous Diagram Appliance—Reducing Wheels—Boiler Test Pumps—Vacuum Pumps—Planimeters—Electrically Operated Chime Whistles—Valves for Steam, Ammonia, etc.

*All CROSBY Quality.*

Address any of our stores and you will receive a prompt and courteous reply.



# J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties

QUALITY  GAUGES

**Pressure Gauges** for steam, water or air, or vacuum. Pressure gauges gradu-



**Pressure Gauge**

ated to any pressure not exceeding 500 lbs. Vacuum gauges graduated to 30".

Type "D" Short Spring, strong, non-freezable.

Model "GAS" Short Spring, strong, non-freezable, with Auxiliary Helical Spring attached to end of main spring, lengthening life of gauge where fluctuation of pressure or vibration is excessive.

Model "GDS" Double Spring, strong, non-freezable, made of one piece of seamless drawn bourdon tubing, insuring accuracy.

**Pressure and Vacuum Gauge:** Generally used on Compound Engines, Receivers, and Heating Systems.

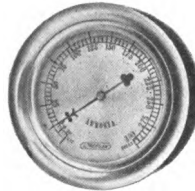
**"Combination" Water Works Gauge:** Used to indicate pressure of water per square inch and corresponding height of column of water in feet. Adapted for use in Water Works, Pumping Stations, Mines, Stand Pipes, etc.

**"Altitude" Gauge:** Used to indicate height of water in feet in tanks, reservoirs and in connection with Hot-water House-heating Systems. Are generally graduated to 70 feet.

**Double and Auxiliary Spring "Locomotive" Gauges.**

**"Tractor Engine" Gauges:** Generally graduated to 300 lbs.

**"Ammonia" Gauge:** Made expressly for use with ammonia and other liquids affecting brass. Tubes are made of a



**Ammonia Gauge**

very high-grade steel and carefully tempered. For use on ice and refrigerating machines.



**Hydraulic Gauge**

**"Hydraulic" Gauge:** Can be graduated to any pressure not exceeding 20,000 lbs. per square inch.

Mechanical Men simply read our SPECIFICATIONS and are convinced.

"Movement" for all of our high-grade gauges. All wearing bearings have PHOSPHOR BRONZE BUSHINGS twice their diameter in length.

Sector, cast bronze, with face three times as wide as the regular sector.

Pinion, Arbor and Hair Spring, made of PHOSPHOR BRONZE.

This insures a gauge with exceptional wearing qualities, long life and accuracy.

"Springs" made for hard work.

Sector suspended vertically which reduces wear on teeth of sector and pinion to a minimum.

"Dials" all graduated by hand, made of brass, silver plated with black lettering.

245

ALL GAUGES EQUIPPED WITH



Non-Corrosive Movement—Sectional View

# UNITED STATES GAUGE CO.

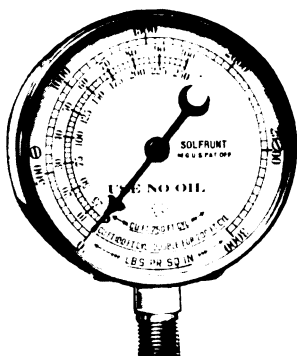
67 WALL ST., NEW YORK, N. Y.

WORKS: SELLERSVILLE, PA.

CHICAGO BOSTON DETROIT PHILADELPHIA SAN FRANCISCO NEW ORLEANS MONTREAL

Manufacturers of Pressure Gauges Exclusively

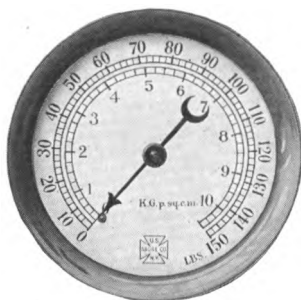
## OXY-ACETYLENE GAUGES:



246

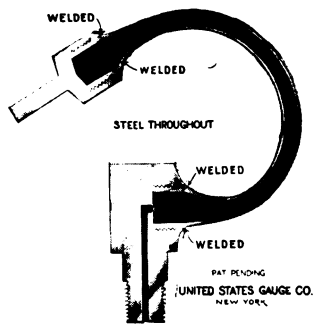
Graduated to indicate pressure and cubic feet in standard oxygen cylinders. Patented safety features comprise solid cast front and full back safety release. Used by over 80% of the oxy-welding field.

## UNIVERSAL DIAL GAUGES:



U. S. Standard Universal Dial Gauges, combining the American and metric standards, meet all export requirements.

## IMPROVED AMMONIA GAUGE:



By WELDING instead of soldering the parts composing it, we have succeeded in making ONE UNIT of the most important part of the gauge—the Bourdon Tube. This eliminates all joints. Where there are no joints, leak possibilities are reduced to a minimum.

## SERVICE:

Engineers who come across difficult or peculiar problems in connection with gauges will do well to consult with our Service Department.

No effort will be made to *Sell* them, but the accumulative specialized experience of our engineers will be placed at their entire disposal. No obligation will be incurred.



IF IT'S A GAUGE WE MAKE IT.



## THE BROWN INSTRUMENT CO.

PHILADELPHIA, PA.

NEW YORK

PITTSBURGH

DETROIT

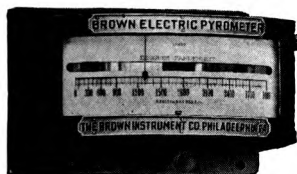
CHICAGO

St. LOUIS

**Manufacturers of Pyrometers, Thermometers, Tachometers, Time and Operation Recorders, Recording Gauges, Voltmeters and Ammeters**

### BROWN PYROMETERS:

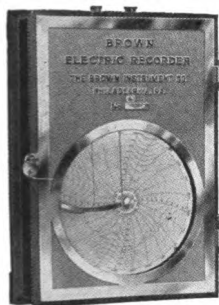
Operate on the thermo-electric principle. Adapted for all ranges of temperatures from 300° F. to 3000° F. For temperatures below 300° F., Brown Resistance Thermometers are recommended. For temperatures above 3000°



[The Brown High Resistance Indicating Pyrometer F., the Brown Radiation Pyrometer is used.]

For temperatures below 300° F., Brown Resistance Thermometers are recommended. For temperatures above 3000°

### BROWN RECORDING PYROMETERS:



The Brown Recording Pyrometer

Make a permanent record of temperatures—single or multiple charts.

Brown Pyrometers are also made to regulate or control automatically the temperature of electric, gas, or oil furnaces.]

### BROWN RECORDING PRESSURE GAUGE:



The Brown Recording Pressure Gauge

For recording all ranges of vacuum and pressure from a few ounces of water to 5000 lbs., Brown Recording Pressure Gauges are guaranteed completely as to dependability and accuracy.

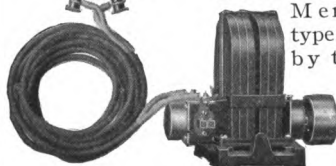
### BROWN LONG DISTANCE RECORDING THERMOMETERS:

Operate on the well-known principle of the expansion of gas or liquid with change of temperature. Capillary tubing can be 100 ft. Fitted with flexible steel-armored tubing.



The Brown Recording Thermometer

### BROWN TACHOMETERS:



The Brown Indicating Tachometer

Indicating and Recording types for measuring and counting revolutions per minute. The Electric type records machine operations hundreds of feet away. The

247

Mercurial type operates by the unvarying law of centrifugal force.

### BROWN TIME RECORDERS:

Extensively used for recording the time of operation of machinery, switches, valves, pumps, and for recording the reversals of glass melting tanks, open hearth furnaces and annealing furnaces; also for recording the time of starting and stopping of paper machines and other devices.



The Brown Time Recorder

### OTHER SCIENTIFIC INSTRUMENTS:

Thermometers of the Mercurial type, recording gauges, temperature controllers, and vacuum gauges are among other scientific instruments produced in our Laboratory, Wayne Junction, Philadelphia, where visitors are always most welcome.

# THE BRISTOL COMPANY

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BOSTON  
Old South Bldg.

NEW YORK  
114 Liberty St.

PITTSBURGH  
Frick Bldg.

CHICAGO  
Monadnock Bldg.

SAN FRANCISCO  
Rialto Bldg.

Manufacturers of Bristol Recording Instruments for Pressure, Temperature, Electricity, Motion, Time, Speed, Etc.

## BRISTOL'S RECORDING GAUGES:

For steam, air, gas and liquids. For all ranges of pressure and vacuum.



Recording Gauge

## BRISTOL'S RECORDING LIQUID LEVEL GAUGES:

For automatically recording depths or levels of water or other liquids.

## BRISTOL'S RECORDING THERMOMETERS:

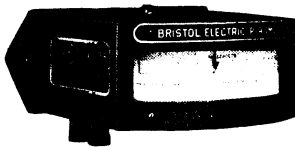
248

For all commercial ranges of temperature from 60° below zero to 800° F.



Recording Thermometer ]

## BRISTOL'S INDICATING ELECTRIC PYROMETERS:



Indicating Pyrometer

High resistance model, for measuring temperatures up to 3000° F.

## BRISTOL'S RECORDING PYROMETERS:

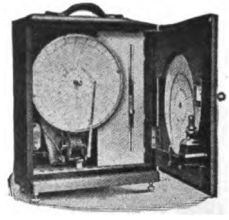
High Resistance Model for recording temperatures up to 3000° F.



Recording Pyrometer

## BRISTOL'S RECORDING VOLTMETERS, AMMETERS AND WATTMETERS:

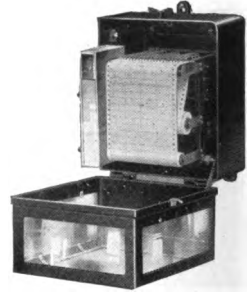
For all ranges of A. C. and D. C. Can be furnished for switchboard or portable service.



Portable Voltmeter

## BRISTOL'S ELECTRICAL AND MECHANICAL OPERATION RECORDERS:

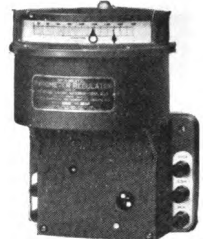
For recording time of mechanical movements, machine operation, valve reversals, etc.



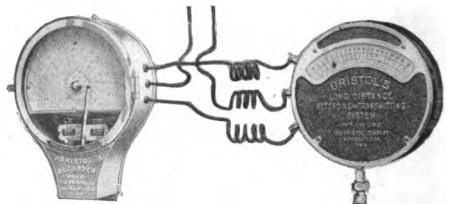
Operation Recorder

## BRISTOL'S ELECTRIC TEMPERATURE CONTROLLER:

For measuring and controlling temperatures in gas and electric furnaces, etc.



Temperature Controller



Long Distance System

## BRISTOL'S PATENTED LONG DISTANCE ELECTRIC TRANSMITTING AND RECORDING SYSTEM:

For measuring and recording at remote points, pressure, liquid level, temperature and motion. For instance, records may be transmitted over distances of five miles or more.

## THE FOXBORO CO., INC.

FOXBORO, MASS.

Indicating, Recording and Controlling Instruments for Pressure, Temperature, Speed, Time and Flow

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH CLEVELAND  
ST. LOUIS BIRMINGHAM SAN FRANCISCO TULSA

**FOXBORO**  
TRADE MARK

### FOXBORO-HEATH CO<sub>2</sub> RECORDERS:



These recorders are operated by water syphon with a minimum lag between stack and instrument.

Simple in operation. Make a complete flue gas analysis every three or four minutes. Record shows percentage of CO<sub>2</sub>. A practical and dependable instrument.

### FOXBORO RECORDING GAUGES:

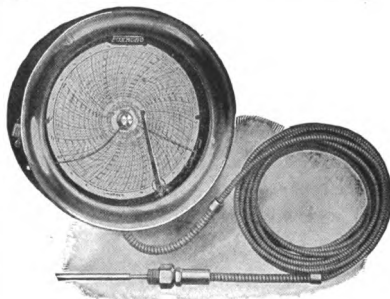
New inverted type will not allow ink to run down pen arm and blot the record.



Any range from full vacuum to 20,000 lbs. per square inch. For Steam, Gas, Water, Oil, Air, Brine, Ammonia—in fact, anything under Pressure or Vacuum.

### FOXBORO RECORDING THERMOMETERS:

These depend upon expansion of liquids, gas, and the vapor tension of volatile liquids for their action.



Adapted for any operation where an accurate knowledge of temperature is needed. Any range from  $-60^{\circ}$  to  $+1000^{\circ}$  Fht., or equivalent degrees in Centigrade and Reaumur. No multiplying devices used. Permanency guaranteed.

249

### FOXBORO LIQUID LEVEL RECORDERS:

Built primarily for recording varying levels of rivers, reservoirs, canals, forebays, tail-races, etc. Have been widely adopted for sewer work, weir measurements, specific gravity recorders.



Many large Paper Mills use them on their Jordan Stuff Chests to get closer weights and more uniform products.

Write for Bulletins.

# THE SCHAEFFER & BUDENBERG MFG. CO.

BROOKLYN, NEW YORK

CHICAGO

PHILADELPHIA

TULSA

LOS ANGELES

PITTSBURGH

SEATTLE

SAN FRANCISCO

SALT LAKE CITY

The Steam Supply & Rubber Co.

F. C. Richmond Machinery Co.

Instruments for Measuring, Indicating, and Recording Temperature,  
Pressure and Speed

**S & B GAUGES:** A complete line of Pressure, Vacuum and Draft Gauges for all requirements, also Column Gauges, Mercury Pressure and Vacuum Gauges, Gauge Testers, etc.

## "CRESCENT" THERMOMETERS:



250

Among our line of high grade "Crescent" Thermometers will be found an instrument for practically every purpose. Our catalog No. 200 illustrates over seventy types. Handsome in appearance and perfect in mechanical detail and construction. Specify size of scale case Thermometer desired, graduation, character and size of connection, character and length of stem, and the purpose for which the thermometer is to be used.

## "REFORM" THERMOMETERS:

A dial face, mercury-filled indicating thermometer having the accuracy of the standard glass tube thermometer and the reading convenience of a dial face. Entire working mechanism is made of steel, meaning long life. Standard size of dial 6 inches. Other sizes made to order. Furnished with either rigid connection or flexible capillary steel tube connection. The latter greatly facilitates installation. State the graduation desired, character and length of connection, and the purpose for which the thermometer is to be used.



"Reform" Thermometer

## "COLUMBIA" RECORDING THERMOMETERS:

The most simple, yet the most reliable type of Recording Thermometer. Mercury actuated, therefore absolutely accurate. Steel construction throughout combining extreme strength and durability with accuracy. Uniformity graduated, wide and effective ranged charts with the popular day and night border, made in two sizes, 8" and



"Columbia" Recording Thermometer

12", respectively, for 24 hours or 7 days. Furnished with either rigid connection or flexible steel protected steel capillary connecting tubing of any length. State size of chart and graduation, length and character of connection and the purpose for which the recorder is to be used.

## THE "COLUMBIA" RECORDING GAUGE:

An exceptionally accurate and reliable instrument adaptable for all ranges of pressure, vacuum and draft. In portable and stationary types, for 8" and 12" day and night charts, respectively, making one revolution in 24 hours or 7 days as desired.



State size of chart and graduations, and the purpose for which the Recorder is to be used.

The Columbia Recording Gauge

## "COLUMBIA" TACHOMETERS:

We have a most complete line of Hand and Stationary Tachometers and we have recently added many new styles and types, covering absolutely every requirement met with in practice. Constructed on the most modern principles, accuracy guaranteed, compact and durable in construction, perfect in mechanical detail and handsome in appearance.

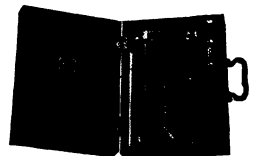
State desired graduations and if Stationary Type Tachometer is wanted, the diameter and the normal speed of the shaft you will drive from.

"Columbia" Tachometer

## CALORIMETERS:

We manufacture Professor Carpenter's pattern Calorimeters for Steam. The throttling type of Steam Calorimeter serves for determining the amount of moisture contained in steam by measurement of the heat. The Separating type is designed to show the percentage of water by mechanical separation of the water from the steam.

S & B Calorimeters are easily operated, requiring no technical knowledge, and results are most satisfactory for practical problems.



Calorimeter



## C. J. TAGLIABUE MFG. CO.

18 to 88 THIRTY-THIRD STREET, BROOKLYN, N. Y.

### BRANCH OFFICES

BOSTON

CHICAGO

PITTSBURGH

TULSA, OKLA.

PORTLAND, ORE.

SAN FRANCISCO

**Manufacturers of Instruments for Indicating, Recording and Controlling Temperature, Pressure, Liquid Levels, Condensate; Oil Testing Instruments, Gages, Etc.**

### APPLICATION:

All "TAG" controllers are supplied with variations of features to best meet specific requirements. These controllers can be advantageously employed in practically every industry where a *uniform* temperature, pressure, etc., is a factor of importance.

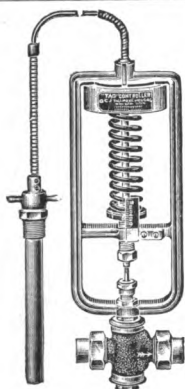
#### "TAG" Self-Operating CONTROLLERS:

Require no auxiliary motive power and can be applied either in a vertical or horizontal position. They are so simple to operate and sensitive in action that all the attendant need do is to "set" the controller for the desired temperature or pressure and "forget it". Temperature ranges within 120° to 290° F.; pressure, 2 to 70 lbs.

Write for Bulletin A-388.

#### "TAG" Perfect TEMPERATURE CONTROLLERS:

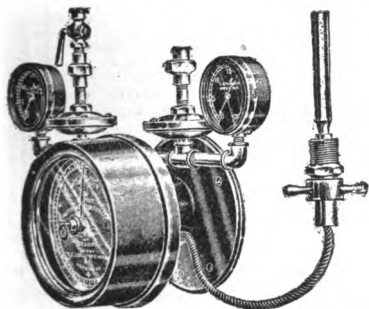
Are operated by means of compressed air and are



"TAG" Self-Operating Temperature Controller



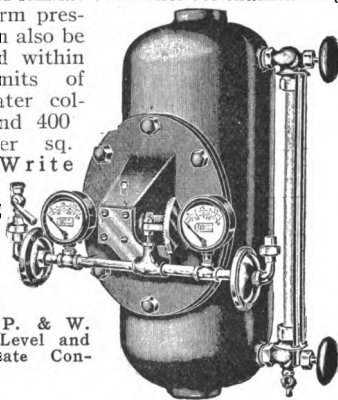
"TAG" Self-Operating Pressure Controller



"TAG" Perfect Automatic Temperature Controller

recommended where *extreme* accuracy is of vital importance. Supplied in various ranges from -40° to 900° F. or equivalent. A similar controller for maintaining a uniform pressure can also be supplied within the limits of 1/25" water column and 400 lbs. per sq. inch. Write

for Catalog A-425.



"TAG" P. & W. Liquid Level and Condensate Controller

#### "TAG" P. & W. LIQUID LEVEL AND CONDENSATE CONTROLLERS:

Are unequalled for automatically maintaining the liquid level in evaporators, etc., at the *exact* height required; also for effectively discharging any volume of condensate and air from drying apparatus, etc. Write for Bulletin A-406.

#### "TAG" INDUSTRIAL THERMOMETERS:

Are essential wherever accurate temperature readings are an important factor. Their *permanent* accuracy is guaranteed. Scale limits from -60° to 1000° F. above or equivalent. Write for Bulletin A-325.

#### "TAG" RECORDING THERMOMETERS:

For temperatures from 60° F. to 800° F. or equivalent of self-contained and long distance forms. Write for Catalog A-345.



"TAG" Industrial Thermometer



*Thermometers, Regulators, Pyrometers, Anemometers, Etc.*

# TAYLOR INSTRUMENT COMPANIES

INDUSTRIAL DEPARTMENT

ROCHESTER, N. Y.

**Manufacturers of a Complete Line of Instruments for the Indicating, Recording and Regulating of Temperature and Pressure**

**NEW YORK**  
Bank of Metropolis Bldg.,  
31 Union Square  
**WASHINGTON**  
327 Colorado Bldg.

**BOSTON**  
44 High St.

**CHICAGO**  
Heyworth Bldg.,  
29 E. Madison St.  
**ST. LOUIS**  
Frisco Bldg., 906 Olive St.

**PHILADELPHIA**  
1318 Stephen Girard  
Bldg.  
**TORONTO**  
201 Royal Bank Bldg.

## TYCOS RECORDING THERMOMETERS:

Give continuous records of temperature. Made in both self-contained and flexible tube form (mercury actuated and vapor tension types) for all industrial applications. Range—40° to 1000° Fahr.



Tycos Recording Thermometer

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## TYCOS AUTOMATIC TEMPERATURE AND PRESSURE REGULATORS:



Tycos Temperature and Pressure Regulator

For processes requiring uniformity of temperature or pressure conditions. Type "A" illustrated above has a separable sleeve. Regulator can be removed from tank without drawing off contents.

## TYCOS PYROMETERS:



Tycos Pyrometer

Base Metal—0 to 2200° F.  
Rare Metal—0 to 3000° F.

## FERY AND FOSTER RADIATION PYROMETERS:

No upper limit of range.

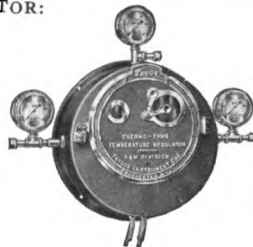
All forms furnished in single or multiple outfits, Indicating or Recording.

All Tycos Recording Pyrometers furnish ink records on charts having Rectangular coordinates.



Tycos  
Pyrometer  
Switchboard

## TYCOS 'THERMO-TYPE' TEMPERATURE REGULATOR:



Automatically controls the length of time required to reach a fixed temperature as well as controlling the temperature after it has reached this maximum. Especially adapted to industrial applications requiring a gradual increase of temperature to a certain point and then control at this point without fluctuation.

If interested in Temperature Regulators, Pressure Regulators; Recording Thermometers, Angle and Straight Stem Thermometers, Engraved Stem Thermometers, Hygrodeiks and Hygrometers, Thermo-Electric and Radiation Pyrometers, our catalogues are indispensable—May we place them in your hands? Name type of instrument in which you are interested.



H & M Indicating Thermometer for Stack Temperatures

# WESTON ELECTRICAL INSTRUMENT COMPANY

49 WESTON AVE., WAVERLY PARK, NEWARK, N. J.

Manufacturers of Instruments for Every Field of Electrical Measurement

New York  
Chicago  
Philadelphia  
Seattle

Boston  
Cleveland  
Detroit  
Miami, Fla.

St. Louis  
San Francisco  
Denver

Cincinnati  
Pittsburgh  
Richmond

Buffalo  
Minneapolis  
New Orleans

Toronto  
Montreal  
Halifax  
Winnipeg

Vancouver  
Calgary, Alta  
Florence, Italy  
London

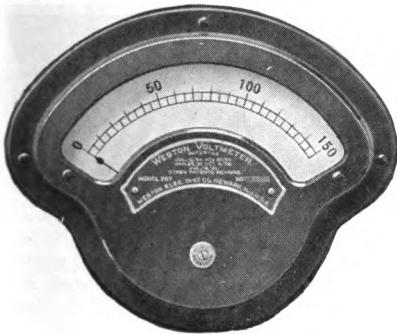
Copenhagen  
Petrograd  
Calcutta, India  
Johannesburg, S. A.  
Batavia, Dutch East Ind.

Auckland, N. Z.  
Sydney, N. S. W.  
Melbourne  
Havana

Mexico City  
Rio de Janeiro  
Buenos Aires

## Weston

### D. C. SWITCHBOARD FAN-SHAPED INSTRUMENTS:



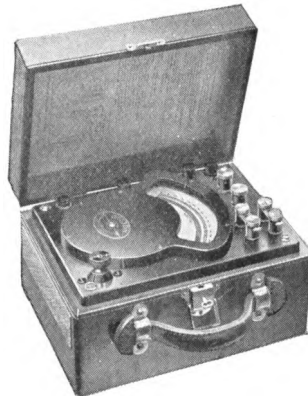
Comprise a group of switchboard instruments similar in shape but graded in size, which possess the standard Weston characteristics so familiar to engineers and manufacturers of electric equipment.

These instruments are particularly adapted to general switchboard practice because the various sizes of instruments available enable the manufacturer to select that one which will be the proper size to harmonize with the other apparatus on the switchboard.

### PORTABLE ALTERNATING-CURRENT INSTRUMENTS:

Of the electrodynamicometer type possess all the characteristics required in a high-grade, accurate, portable instrument. They are accurate within  $\frac{1}{4}$  of one per cent of full scale value on either direct or alternating current.

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No matter what your requirements may be, state them and we will forward appropriate Bulletins,



# JAMES G. BIDDLE

1211-1213 ARCH ST., PHILADELPHIA

Industrial and Scientific Instruments

## THE JAGABI VIBROMETER:

(Write for Descriptive Circular 915.)

A new instrument for determining vibration of:

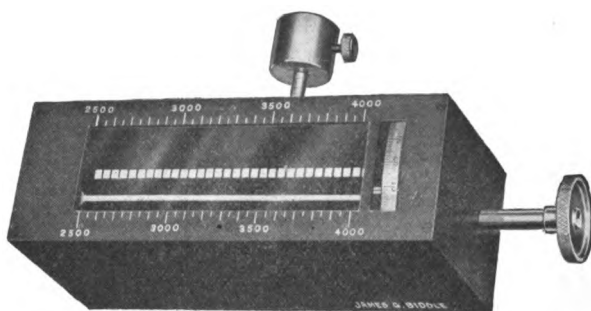
- (A) A machine under various conditions of adjustment—as of balance.
- (B) A machine under various conditions of operation.

and all other machines that run at speeds between the limits above specified.

For full description and Price-List consult Catalog 855.

**Simplicity of Mounting:** No belt, gears, couplings or electrical connections are required—as it is only necessary to screw the Tachometer to a convenient part of the machine under test.

## JAGABI HAND TACHOMETER TYPE C:



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- (C) A machine under ordinary conditions of "wear and tear."
- (D) Two or more machines.
- (E) Surrounding structures and buildings.

## FRAHM VIBRATING-REED TACHOMETERS:

Frahm Tachometers are best suited for indicating speeds between 900 and 8000 R. P. M. For service outside these limits, a special actuating device must be used. After being thoroughly tried

This instrument is direct-reading in revolutions - per-minute, and is independent of the direction of rotation.

The tachometer, without accessories, weighs a trifle more than one pound, and is exceedingly convenient to use. It has a three-inch dial.

There is *only one spindle*, but each instrument combines three ranges—the change from one to another being effected by a gear-shifting device, controlled by a special slider.

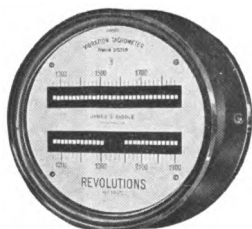
We aim to carry the following in stock:

	R.P.M.			
No. 226 Range	60-240,	100-400,	600-2400	
No. 231 Range	100-400,	300-1200,	1000-4000	
No. 236 Range	150-600,	500-2000,	1500-6000	
No. 241 Range	300-1200,	1000-4000,	3000-12000	

Prices upon request. Ask also for Circular 395.

## OTHER BIDDLE SPECIALTIES:

Megger Testing Sets and Bridge Meggers; Evershed Low Range Ducters; Laboratory and Portable Voltmeters, Ammeters, Wattmeters, Shunts, Multipliers and Transformers; Frahm Vibrating-Reed Frequency Meters; Laboratory Rheostats; Etc.



out under long-continued service conditions, these unique tachometers are being used by all builders of steam turbines. In many cases they are included as part of standard equipment—and in others are specified by purchasing engineers. Their field of greatest usefulness includes steam turbines, centrifugal pumps, centrifuges, turbo-blowers, dynamos, motors



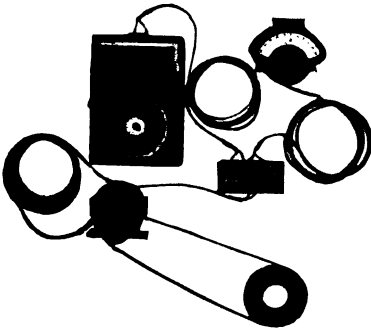
# THE ELECTRIC TACHOMETER CORP'N

PHILADELPHIA, PA.

95 LIBERTY ST., NEW YORK CITY

**Manufacturers of TETCO Indicating and Recording Tachometers.  
Portable, Stationary and Marine Types**

Compared with tachometers operating on a mechanical principle, *electric* tachometers, and especially **TETCO TACHOMETERS**, being of the Direct Current type, have the advantage of greater accuracy and long distance control. The transmitter, a D. C. generator with permanent field, is geared or direct connected to the shaft, whose speed it is desired to record, or to any other shaft revolving at a proportionate speed; the indicator or recording instrument may be located at any distance away from the source of energy.



Combination Indicating and Recording Tachometer, Type M-200 AS. E.

The indicator or recorder movements are of the voltmeter type with scales calibrated in R. P. M. or proportional function, such as Miles per Hour, Production Units per Unit time, or Time per Unit of Production.

The potential generated (*i. e.*, the voltmeter reading) is *directly* proportional to the R. P. M. of the generator. Mechanical tachometers depend on different laws, generally centrifugal force.



Portable Tachometer, Type M-600 F

Transmitter and indicator are connected through a double conductor cable. Several instruments of the same type can be operated from one transmitter, or if desired, indicators and recorders, located at various distances from the source of energy. All recorders and indicators are guaranteed to be accurate within plus or minus 1%.

A great variety in indicators can be furnished, to suit different conditions. Two different types of portable tachometers (one of which is a hand type, weighing  $3\frac{1}{4}$  lbs.) are manufactured.



Marine Tachometer System for Twin Screw Vessel. 4 Indicators—2 Transmitters

The Electric Tachometer Corporation specializes in Marine and Naval Tachometers (approximately 250 U. S. Navy vessels have been fully equipped), tachometers for paper mills showing production of paper, tachometers for mechanical stokers of the Underfeed type, railroad tachometers and precision instruments for laboratory and general test purposes.



Send us data as to maximum speed, drive shaft diameter and distance required between drive point and indicator or recorder.

*Literature sent upon application.*

# DURANT MANUFACTURING CO.

MILWAUKEE, WIS.

Manufacturers of Automatic Counters

## The Productimeter

keeps an accurate record of production or operations as they are performed; is made in several different styles for adapting it to practically every kind of application in which counters can be successfully used. Each model is also made in different sizes, resetting and non-resetting, plain and with lock to prevent tampering by operators. Every Productimeter is subjected to the most rigid machine tests and thorough inspection before shipment, so that its count may be relied upon absolutely.

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MODEL A

A ratchet counter of extremely substantial construction, easily reset, adapted particularly to stamping presses, punches, etc. It is also supplied with alarm bell for special applications.

Style	No. of Figs.	Counting up to	Size Inches	Weight Pounds
4A-1	4	9999	7 x 2 1/4 x 1 3/4	3
5A-1	5	99999	8 1/2 x 2 1/4 x 1 3/4	3 1/2
6A-1	6	999999	10 x 2 1/2 x 1 3/4	4



MODEL B

A compact, full-geared positive counter with instantaneous reset. Can be secured to a vertical or horizontal surface and the operating lever can be placed in any posi-

## MODEL B (Cont'd.)

tion at either end of case, adapting it to an exceptionally broad range of uses.

	Size, Inches	Weight Pounds
Standard with outside reset, 5 B-1.....	3 3/4 x 2 5/8 x 2 1/8	2 3/4
Rotary drive outside reset, 5 B-7.....	3 3/4 x 2 5/8 x 2 1/8	2 3/4
With Lineal Measure Attachment, 5 B-8.....	.....	7
Above with 6 Fig., 6 B-1.	4 1/2 x 2 1/2 x 2	3 1/4



MODEL C

Designed for unusually severe usage. Thoroughly rust-proof. Particularly adapted to engines, compressors, automatic scales, coal-handling machinery, etc.

Size, Inches	Weight, Pounds
4 1/2 x 3 x 2	3 1/2

Made in 4, 5, and 6 figures resetting or non-resetting.

## MODEL D

A small, compact counter with a sturdy, accurate driving mechanism, instantaneous



reset, and light action; adaptable to small presses and other light machinery. The rotary type is more heavily built and adapted to looms and other textile machines.

	Size, Inches	Weight Pounds
Standard with outside reset, 5 D-1.....	2 x 1 3/4 x 1 1/8	3/4
Rotary drive with outside reset, 5 D-6.....	2 3/4 x 2 x 1 1/4	1

Made with 4 or 5 figures

Also Round Case Engine Revolution Counters; Electric Counters; Can Counters, etc.

Send for Productimeter Catalog No. 12.

## SLOCUM, AVRAM & SLOCUM LABORATORIES, INC.

120 PACIFIC STREET, NEWARK, N. J.

Manufacturers of the Productograph

### THE PRODUCTOGRAPH:

Gives an absolute and correct record of lost time, productive working time, average speed and output, and it enables the Manager to put his hands on the weak links of his organization.

### COMPONENT RECORDING FEATURES OF THE PRODUCTOGRAPH:

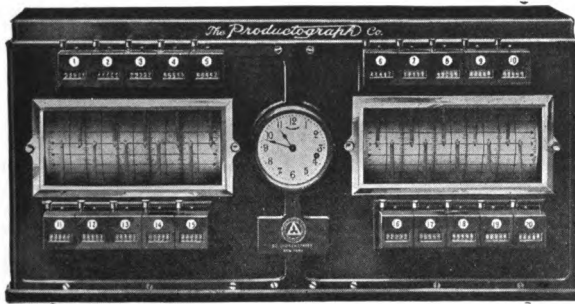
(1) Chart for recording total production, also productive and non-productive time. (2) Counter for reckoning total production.

The Productograph proper and its accessories have a special advantage in that each accessory forms a unit in itself. This arrangement makes it possible

three years: Molding, printing, lithographing, cloth finishing, cloth printing, rope making, brick making, box making, screw making, textile manufacturing, shrapnel, and motor car manufacturing.

**To Engineers:** At the present day of high cost of labor, it is essential that operation costs be minimized. The Productograph will give accurately a minute to minute record on every phase of an organization.

It is therefore essential that engineers familiarize themselves with this instrument, so that they may intelligently recommend its use whenever it can be advantageously used.



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### *The Productograph*

"An Instrument for Recording Efficiency of Machines"

to supply the instrument fully equipped or with any combination of recording features in order to meet the requirements of any type of plant.

**Description:** The productograph is designed to graphically record a complete history of the operations of machinery in a plant irrespective of what is being manufactured. Special switches are installed on the different machines throughout the plant and from these switches wires are brought to the Productograph located in the central office.

With this arrangement the operation of each machine is recorded, thereby providing accurate and immediate information covering the production and time loss of any machine in the plant.

The Productograph has been used in the following industries within the past

Irrespective of the nature of the requirements which may be desirable for any class of manufacturing plant, the Productograph is capable of executing the demands.

**Further information** will be furnished upon request, also data regarding:

(1) The "Productograph Electric Counter" which counts the product or manufactured units by measurement or quantity.

(2) The Accumulator which records the actual producing time in hours, minutes and seconds of any machine in the factory, also denoting whether or not that machine is producing.



TRADE MARK

# PNEUMERCATOR COMPANY

15 PARK ROW, NEW YORK, N. Y.

PHILADELPHIA.....H. S. Parks, 450 N. 10th St.  
CLEVELAND, O.....W. H. Hughes, 512 Hippodrome Bldg.  
CHICAGO, ILL.....H. H. Erickson, 130 N. Wells St.  
SAN FRANCISCO, CAL.....J. C. Ferguson, Monadnock Bldg.  
SEATTLE, WASH.....W. S. De Pierris Co., Hoge Bldg.  
VANCOUVER, B. C.....Brown, Fraser & Co. Ltd., Royal Bank Bldg.  
EUROPE.....Kelvin, Bottomley & Baird, Glasgow, Scotland.

## PRODUCT AND SERVICE:

"PNEUMERCATOR" Gauges indicate the *depth, weight, volume* or *specific gravity* of any liquid or semi-liquid, fluid enough to seek its own level.

## USE:

Tanks, Standpipes or Reservoirs.

A Pneumercator Gauge installed in any tank will provide a perpetual inventory of the liquid stored in the tank—an accurate check on liquid put in or withdrawn from the tank.

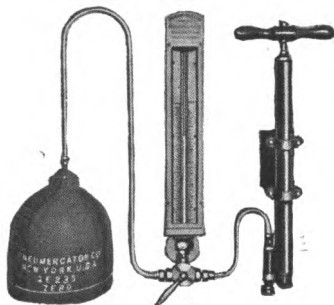
The gauge will operate with equal accuracy on tanks open to the atmosphere or under Pressure or Vacuum.

258 The accuracy is not affected by changes in temperature of the liquid in the tank, or the temperatures through the pipe line connecting the tank to the indicating portion of the apparatus.

There are no floats, diaphragms or delicate mechanism of any kind to stick or get out of order.

## PRINCIPLE:

The operation of all models of "Pneumercator" gauges is based on the maintenance of a true hydrostatic balance between the head of liquid to be measured and a column of mercury or other indicating medium, the pressure being transmitted by air confined in a small connecting tube between the liquid and the gauge.



## CONSTRUCTION: Four Elements.

1. A balance chamber, located in the liquid to be measured.
2. A mercury or other gauge, located wherever readings may most conveniently be taken.
3. A hand pump or other source of compressed air.
4. A control valve attached to the gauge, and connected by small piping to the balance chamber and to the source of compressed air.

## APPLICATIONS:

Fuel Oil Tanks  
Acid Tanks  
Molasses Tanks  
Gasoline Tanks  
Chemical Storage Tanks  
Still  
Evaporators  
Automatic Sprinkler Tanks  
Automobile Tank Trucks  
Reservoirs  
Standpipes  
Flumes  
Tail Races  
Dams  
Water Works  
Tide Fluctuations, etc., etc.

## NOTICE:

The coined word "Pneumercator" is registered as our trade mark and attached to all instruments sold by us, our representatives or licensees under our patents throughout the world.

AS EACH "PNEUMERCATOR" GAUGE has to be made up for the specific purpose for which it is to be used, in order to advise and quote you intelligently it is necessary that we have the following information:

The dimensions of tank (or tanks), depth, diameter and cubical capacity per inch.

The distance from the tank to the indicating portion of the instrument.

The nature and specific gravity of the liquid to be measured.

Prices and full information will be promptly furnished on request.

**CATALOGUE SECTION  
PART III**

**Power Transmission  
Machinery**

**259**

**Pages 261-332**



## THE A. & F. BROWN CO.

Established 1854

79 BARCLAY STREET,  
NEW YORK CITY

Incorporated 1898

WORKS:

ELIZABETHPORT, N. J.

**Engineers, Founders, Machinists and Millwrights. Manufacturers of Gears of all Descriptions, Turned Steel Shafting, Pulleys, Split Pulleys, Friction Clutches, Special Machinery, Etc.**

### CUT GEARS:

These gears are cut on the best up-to-date automatic machines obtainable, enabling this department of the shops to turn out accurately cut gears of every description and size.

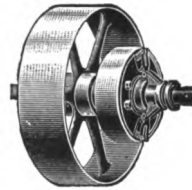


### MACHINE MOULDED GEARS:

The Gear Department of our foundry is fitted up with the most modern gear moulding machines, enabling us to furnish machine moulded gears up to 16 feet diameter, and 25 tons in weight if in one piece, and heavier if split, or built up. These gears are much more accurate than ordinary cast gears and are of the toughest mixture of iron.

### FRICTION CLUTCHES:

The F. Brown Friction Clutch is simple, compact and having few small parts is not liable to get out of order; engages gradually and when thrown "in gear" has a stronger grip than any other, owing to the large friction surfaces and powerful operating device which is a combination of double-ended (or right and left thread) screw and toggle joint.



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### SIRENS:

These fog signals are used by the United States Navy and Lighthouse Departments, also by a number of foreign governments and many steamships. They are also in use as fire alarm signals in small towns and large manufacturing plants.

### COGSWELL MILL:

The problem of grinding or pulverizing many materials has been successfully solved by this machine.

### SPECIAL MACHINERY:

These shops are particularly well equipped for building special machinery to plans and specifications. The pattern shop, foundry and machine shops are strictly up to date in all particulars and equally well equipped to turn out work of the heaviest character as well as light machinery requiring first class material and workmanship and most modern tools.



# THE FALK COMPANY

MILWAUKEE, WISCONSIN

Manufacturers of Precision Herringbone Gears with Staggered Teeth (Wuest Patents)

## FALK HERRINGBONE GEARS:

We manufacture a complete interchangeable system of herringbone gears, with teeth generated on special machines, designed and built exclusively for our own use.

Invariable spiral angle.  
Perfect interchangeability.  
Equal efficiency in both directions.

## SPECIAL ADVANTAGES:

Long life.

High efficiency (loss never exceeds 1% at rated load).

Elimination of counter-shafts and double-gear trains.

Absence of vibration with prevention of shaft crystallization and breakdown of motor insulation.

Quiet action with durable steel pinions.

## SIZES:

We manufacture hobbled herringbone gears in the following sizes:

Any pitch, from 10 D. P. to  $\frac{3}{4}$  D. P.

A Large Set of Falk Gears for an Aluminum Mill

262



Fig. 1

The gears which we produce are hobbled, both sides at once, in solid blanks.

The Wuest System of staggered teeth, besides giving the maximum contact surface for a given width of face, is invaluable in securing unbroken continuity of engagement when using high ratio pinions with very few teeth.

Other distinctive features:

Highest attainable accuracy.

Involute tooth form on *circumferential* section.

Any face, from  $1\frac{1}{4}$  inches to 72 inches.

Any diameter, from 2 inches to 16 feet.

True spiral gears of constant angle cut to standard diametral pitch like spur gears.

Referring to illustrations, Fig. 1 shows a large set of Falk gears for an aluminum mill. Fig. 2 shows a high ratio double reduction gear unit for 3000 H. P. marine turbine drive—U. S. Shipping Board. Fig. 3 is a standard type of herringbone gear unit for motor-driven rolling mills.



# THE FALK COMPANY

## FALK HERRINGBONE GEARS:

FALK HERRINGBONE GEARS transmit power by smooth, continuous action without jar, shock or vibration.

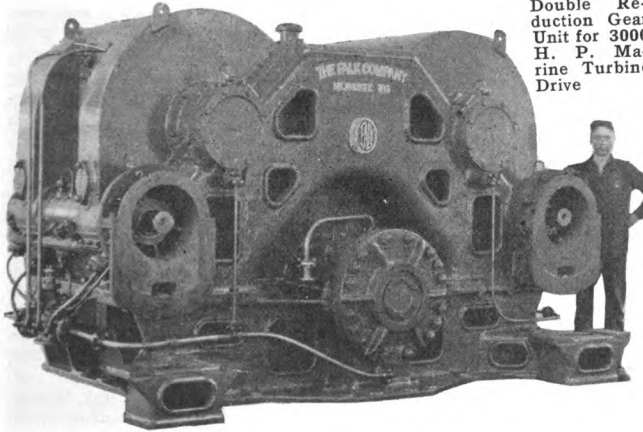


Fig. 2

They are almost noiseless.

They can be used for extremely high single gear ratios. In this connection we make a specialty of forged pinions in one piece with their shafts. Ratios of 15 to 1 are quite normal and 20 to 1 may be used when necessary. Wuest gears can be run with safety at far higher velocities than the spur type. Special gears for use in connection with steam turbines are suitable for speeds up to 10,000 feet per minute.

*Specially adapted for:*

Marine Steam Turbines.

Turbo-Generators.

Turbine-Driven Centrifugal Pumps, Mills and Shafting.

Rolling Mills and Rod Mills.

Tube Mills and Crushing Plant.

Power Pumps.

Air Compressors and Blowers.

Hoisting, Elevating and Conveying Plant.

Rubber Machinery.

Machine Tools. 263

The range of application for Wuest herringbone gears covers every case

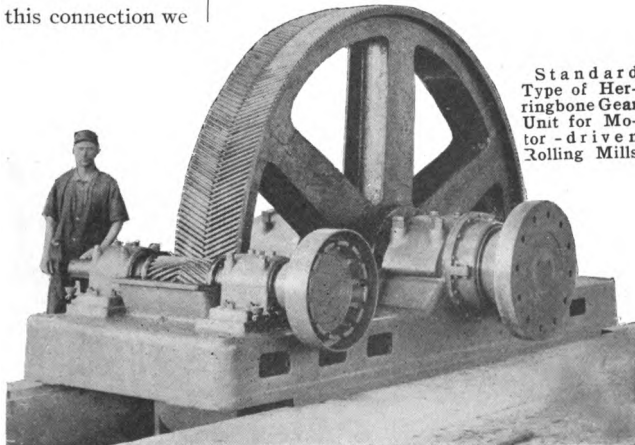


Fig. 3

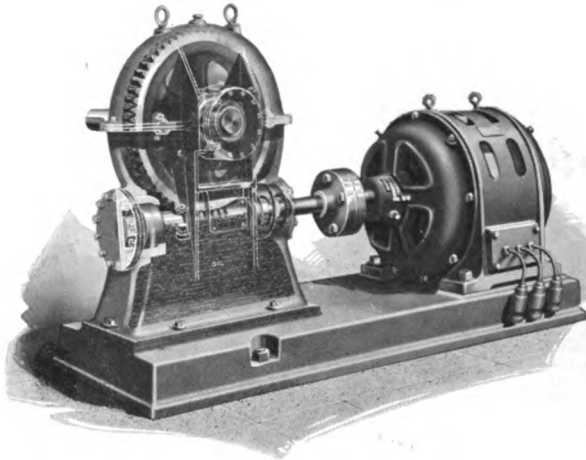
where spur gears are used and many new fields where spur gears are impossible.

## THE CLEVELAND WORM GEAR CO.

CLEVELAND, OHIO

C. F. QUICKE & Co., 315 Euston Rd., LONDON, E. C.

Manufacturers of Worm Gears and Worm Gear Reduction Units



Cleveland Worm Gear Reduction Unit

Their use has been found exceedingly profitable for rubber mill and calender drives, by paper mills for the same purposes, by mining companies in connection with winch hoists, etc., and conveyor drives, pump drives, drives for heavy machinery of all types, drives for boiler houses, etc.

Recent developments in the line of high efficiency light weight steam turbines, indicate the wonderful value of the Cleveland Worm Gear Reduction Unit in this immense field.

### 264 WORM GEARING:

The Cleveland Worm Gear Company is the only concern in America devoting its entire energies to the production of fine worm gears. It makes worm gears for use in motor trucks and tractors, and Cleveland Worm Gear Reduction Units for use in factories and anywhere that gear reductions are necessary.

Cleveland worm gears are of the straight type. The straight type worm maintains a constant pitch diameter over its entire surface, and the straight faced tooth offers no basic difficulty to accurate grinding of the flanks of the worm teeth to prevent distortion after hardening. This means uniformity of production—uniform superiority.

Back of Cleveland worm gears is an experience of more than twenty-five years manufacturing worm gears exclusively. No Cleveland worm gear has ever been returned to the factory because of faulty design.

### CLEVELAND WORM GEAR REDUCTION UNITS:

Cleveland Worm Gear Reduction Units are being used in hundreds of factories throughout the United States wherever speed reduction must be effected. They solve the problem with high efficiency and there is practically no cost of maintenance.

When designing new installations give the Cleveland Worm Gear Reduction Unit consideration as a factor of ultimate economy for all such purposes as are outlined above.

These units are manufactured complete ready for installation, but are built to suit the particular job.

We would be glad to correspond with engineers and others who desire the benefit of our broad and progressive experience in this field.



Cleveland Worm Gear for Trucks and Tractors

# FAWCUS MACHINE COMPANY

PITTSBURGH, PA.

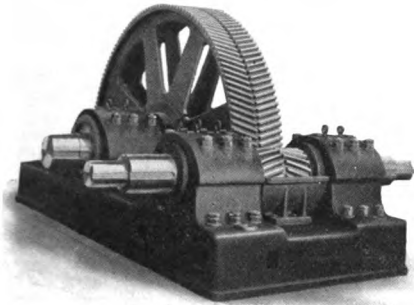
OFFICE  
First National Bank Bldg.

WORKS  
Pittsburgh and Ford City, Pa.

## Cut Gears and Special Machinery

### FAWCUS HERRINGBONE GEARS:

The purpose of Fawcus herringbone gears is to transmit power more quietly and more efficiently than is possible with



Fawcus Rolling Mill Drive

spur gears. Gear and pinion teeth are cut in solid blanks on Fawcus patented hobbing and planing machines.

Opposite halves of each tooth are machined simultaneously, thereby obtaining maximum accuracy of tooth form, spacing and alignment.

Correct construction demands that the two halves of each tooth be set opposite, the apex of the angle being in the center of the gear face. Face width must be so proportioned that teeth will have overlapping or continuous action, the minimum face width being about six times the circular pitch of the teeth for a standard helix angle of  $23^{\circ}$ . All teeth are cut to diametral pitch standards, twenty degrees involute short addendum.

The accuracy of Fawcus gears makes possible their use for high peripheral velocities and large ratios of speed reduction. They may be advantageously used wherever a positive means of transmitting power is required.

The Fawcus Machine Company will gladly lend the best assistance of its engineering department in recommending and quoting on gearing for all purposes.

Valuable engineering data and additional descriptive information on Fawcus herringbone gears will be mailed to engineers and other interested persons on request.

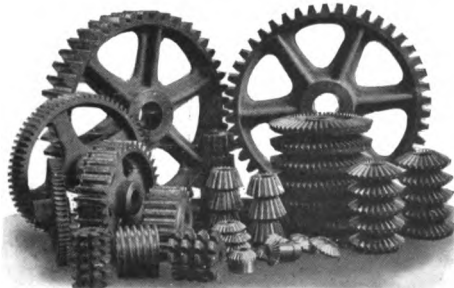
### PRODUCTS:

- Cut Herringbone Gears**  
2 inches to 20 feet diameter.
- Cut Spur Gears**  
2 inches to 20 feet diameter.
- Cut Bevel Gears**  
2 inches to 48 inches diameter.
- Cut Worm Gears**  
2 inches to 10 feet diameter.
- Enclosed Worm Gears**  
5 H. P. to 25 H. P.
- Flexible Couplings**  
For shafts 1" to 20" diameter.
- Special Machinery**  
"Built to your order."
- Standard Enclosed Herringbone Gear Drives**  
25 H. P. to 1500 H. P. (Herringbone Gear Booklet on request).
- Special Enclosed Gear Drives**  
25 H. P. to 15,000 H. P.
- Turbine Reduction Gears**  
25 H. P. to 12,000 H. P.

265

### OUR SPECIALTY:

Is making cut gears to your order. Give us your problem or send specifications. We design complete transmissions. Our shop facilities are such that we can handle orders rapidly. We invite inquiries on any kind or size of gear. The services of our engineers are at your disposal if needed.



FAWCUS CORRECTLY CUT  
GEARING FOR EVERY SIZE OR  
STYLE OF CUT GEAR

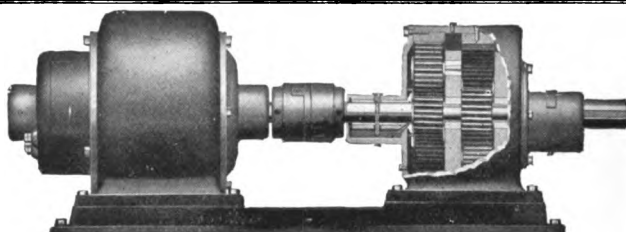
## D. O. JAMES MANUFACTURING CO.

Established 1888

Incorporated 1908

1114-24 WEST MONROE ST., CHICAGO, ILL.

Manufacturers of Speed-Reducing Transmissions, Cut Gears—Gear Cutting



### JAMES SPEED-REDUCING TRANSMISSIONS:

Ratios 4 : 1 to 1600 : 1  
1 H. P. to 100 H. P.

*A Centrally Driven Well-Balanced Drive of Great Emergency Strength.*

James Speed-Reducing Transmissions were designed to eliminate the objectionable features in evidence in other forms of power transmission, and have been developed to meet the requirements of a variety of applications. The James Reducer meets the demands for a reliable and efficient method for reducing the motor speed. Being fully enclosed, it positively eliminates all chances of dirt getting in the working parts and leaves no gears exposed to injure the workman.

#### Compactly Constructed:



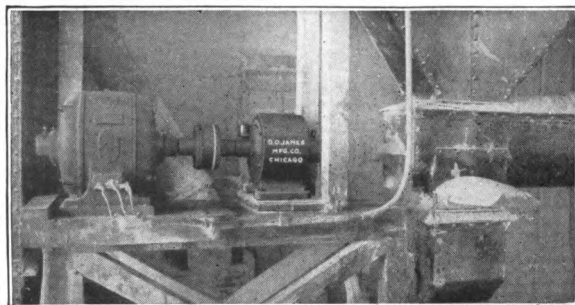
The James Reducer is a unit in itself, compactly constructed, having very much the appearance of an electric motor; is easily installed and can also be arranged for ceiling suspension. It will be found highly efficient, strong and durable, the gearing being entirely enclosed in housing, operating in oil under ideal conditions.

**Wide Range of Adaptability:** James Reducers are admirably adapted for use in brick plants, cement plants, coal mines, excavation work, steel mills, paper mills, and countless other industries of a like nature, where more or less dirt and grit are constantly getting in the exposed gearing, causing excessive wear, requiring but a few months in many instances for their complete destruction.

They find most satisfactory application for use in operating stokers, ore roasters, cereal cookers, conveying and elevating machinery of every description, car pullers, car loaders, hoists, freight and passenger elevators, stuff chests, agitators, mixers, paint chasers, feed driers, garbage driers. Starch and glucose plants will find the fully enclosed features most acceptable.

**Durability:** The long life of the James Reducer is largely due to the fact that the gearing is well balanced, all moving parts running in the same direction, the idlers revolving on case-hardened and ground-forged steel pins.

Each Reducer is thoroughly tested before being shipped.



7½ H. P. Reducer Operating Screw Power Conveyor

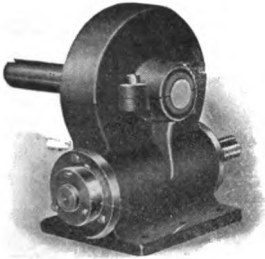
Write for our latest Bulletin No. 6, describing James Speed Reducers.

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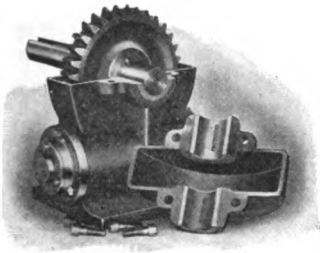
## D. O. JAMES MANUFACTURING CO.

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### ENCASED WORM GEAR REDUCTIONS:



The Worms are made of steel and the Worm Gear Reductions are provided with thrust washers on each side of the Worm, so the worm may be run in either direction. In the design of these Reductions care has been taken to see that the worm and the worm shaft shall receive abundant lubrication.



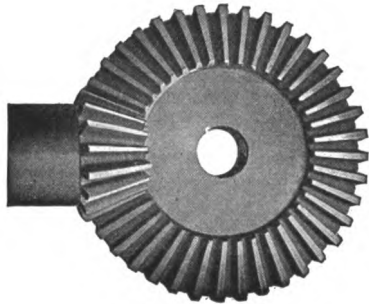
#### Points of Superiority:

1. The worm shaft is fitted in place at the proper center distance, so the worm and gear will run freely.
2. Particular care is taken to see that the worm and gear are cut and hobbled accurately.
3. The housing is constructed so the worm and gear may be easily removed. The worm may be removed by taking

out the worm shaft bearings, and the worm gear may be removed by taking off the cap.

When properly installed and not overloaded but used for the horsepower as listed, our encased worm gear transmissions will give the utmost satisfaction. Each Reducer is thoroughly tested before leaving our shop.

### CUT GEARS:



267

We are specialists in the manufacture of cut gearing and are fully equipped with the most modern machinery for the accurate production of large or small gears in any quantity.

We can furnish gears of every description, our facilities being unexcelled by any plant in the West. We have recently added extensively to our equipment and are better than ever prepared to fill all orders promptly.

Bevel, Mitre, Spur, Spiral, Rawhide and Worm Gears—we can furnish them all and guarantee satisfaction.

## W. A. JONES FOUNDRY & MACHINE CO.

CHICAGO, ILL.

4415 W. ROOSEVELT ROAD

NEW YORK CITY

30 CHURCH ST.

**Manufacturers of Pulleys, Sprockets, Friction Clutches, Rope Drives, Cast Gears, Cut Gears, Speed Reducers and Power Transmission Machinery**

### JONES SPUR GEAR SPEED REDUCERS:

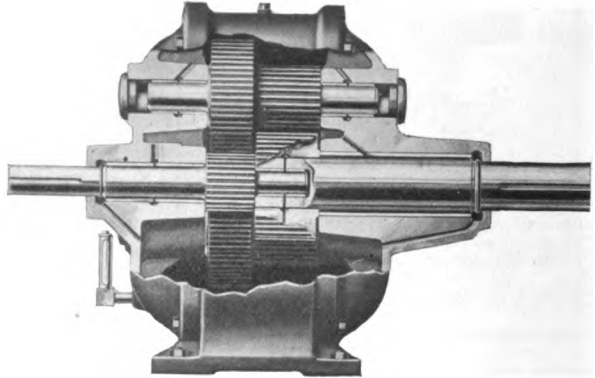
Are designed for reducing speeds between driving and driven units, and are adapted to practically all classes of Mill, Factory, and Plant equipment where reduction in speeds between electric motors and driven units are required. In outward appearance they somewhat resemble electric motors and are about the same size as motors of the same horse power.

**268** All parts of Jones Spur Gear Reducers are accurately made from the highest grade material. All gears and pinions are involute, stub tooth,  $20^\circ$  pressure angle, accurately generated from special steel, are enclosed in cast-iron housings and run in a bath of oil, thus insuring perfect lubrication, long life and freedom from the injurious effects of abrasive dust, acid fumes, etc., in the surrounding atmosphere.

Jones Speed Reducers are Reasonable in Price.

Construction is Simplicity Itself.

No Attention or Upkeep Required.



Sectional View of Jones Single Type Spur Gear Speed Reducer

Economize Space and Reduce Installation costs.

Comply with all Safety Laws.

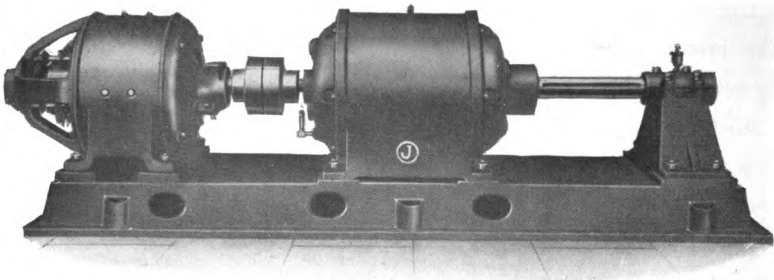
May be used on Floor or for Overhead Inverted Mountings.

Made in Sizes from 1 to 200 H. P. or Over.

With Practically any Speed Ratios up to 200 to 1 or More if Required.

Our Engineering Department will gladly co-operate with you in analyzing your speed reduction problems, and will aid you in selecting that machine best adapted to your particular requirements.

*Write for Bulletin.*



Jones Spur Gear Speed Reducer Mounted on Cast Iron Base

# W. A. JONES FOUNDRY & MACHINE CO.

CHICAGO, ILL.

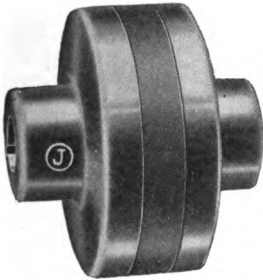
4415 W. ROOSEVELT ROAD

NEW YORK CITY

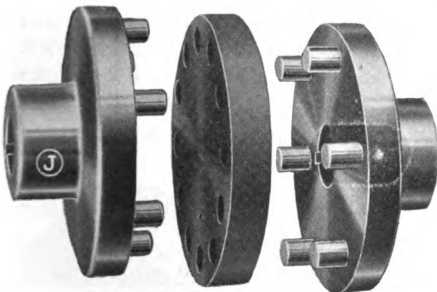
30 CHURCH ST.

**Manufacturers of Pulleys, Sprockets, Friction Clutches, Rope Drives, Cast Gears, Cut Gears, Speed Reducers and Power Transmission Machinery**

## JONES STYLE "A" FLEXIBLE COUPLING:



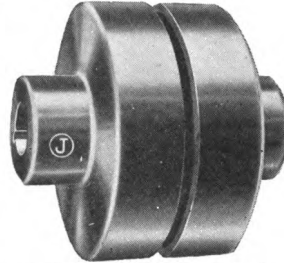
Jones style "A" coupling consists of two cast iron flanges containing a number of steel pins evenly spaced near the outer edges. Between these flanges is a fiber disc in which are a number of equally spaced holes corresponding to and slightly larger than the steel pins, thus permitting a slight amount of float when the coupling is assembled, and automatic adjustment of the coupling to any slight misalignment between the connected shafts.



The style "A" coupling is well adapted for high speeds where the load is not subjected to sudden starting shocks, and is an ideal coupling for motor generator sets.

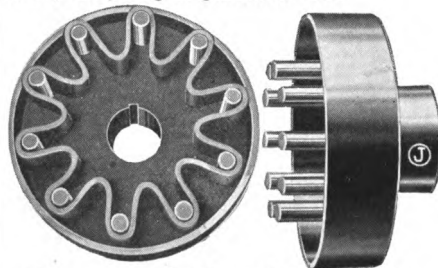
These couplings are of neat, compact design, are finished all over and accurately bored. There are no projecting bolts or other parts to cause accidents.

## JONES STYLE "B" FLEXIBLE COUPLING:



The Jones style "B" coupling is the most flexible coupling on the market and will take care of greater shaft misalignment than the style "A." It also relieves the motor and driven mechanism of much of the vibration caused by a load of pulsating nature such as motor driven compressors, pumps, etc. It is absolutely noiseless in operation, requires no lubrication or other attention, and has no projecting parts to cause accidents.

This coupling is well adapted for motor driven fans and blowers as well as for heavy duty engine generator sets.



The steel pins of the style "B" coupling are connected by a flexible, oil-treated endless leather belt of specially selected stock. In selecting the proper sized belting for our various sized "B" couplings we have allowed a large factor of safety which insures for them a very long life. These couplings are suitable for transmitting loads of up to 500 H. P.

## W. A. JONES FOUNDRY & MACHINE CO.

CHICAGO, ILL.  
4415 W. ROOSEVELT ROAD

NEW YORK CITY  
30 CHURCH ST.

**Manufacturers of Pulleys, Sprockets, Friction Clutches, Rope Drives, Cast Gears, Cut Gears, Speed Reducers and Power Transmission Machinery**

### JONES STANDARD RIGID PILLOW BLOCKS:

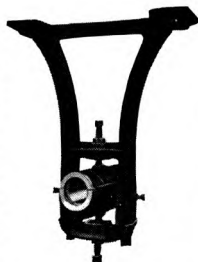


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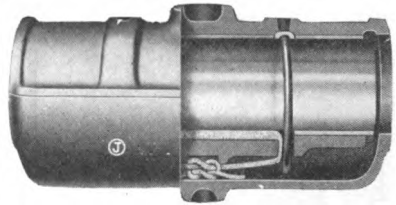
In designing our standard rigid pillow blocks we have deviated considerably from the usual type of plain oiling bearings. Not only is the base finished, but the joint between the base and cap is accurately machined. The bearings are babbitted and accurately bored to size. In order to provide ample bearing surface for taking thrust from set collars, the ends of the bearings are of large diameter and faced square with the bore. The oil holes are tapped to permit the use of grease cups if desired. Quantity production and modern manufacturing methods enable us to meet the prices commonly quoted on ordinary pillow blocks.

### JONES UNIVERSAL ADJUSTMENT HANGERS:

These hangers are so designed that a wide range of adjustment in both lateral and vertical directions is secured within the frame. The bearings have unusually large oil reservoirs and combination ring and capillary oiling. All bearings are babbitted, bored to size and the ends faced.

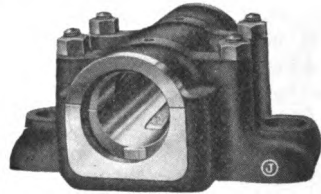


### JONES DUPLEX OILING HANGER BOX:



The above cut shows a sectional view of our duplex oiling hanger box. The same oiling arrangement is used in our Duplex Oiling Pillow Blocks.

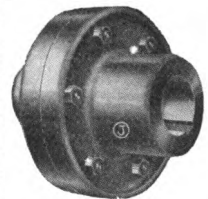
### JONES RIGID DUPLEX OILING PILLOW BLOCK:



These bearings have the same duplex oiling device as our hanger boxes. The bearings are babbitted with a high grade babbitt, accurately bored to size and the ends faced and bottoms finished.

### JONES STANDARD FLANGED COUPLINGS:

Jones Flanged Couplings are of such rugged design and construction that we guarantee them to transmit the full power of the connected shafts. These couplings are finished all over; the bolt holes are drilled in jigs and reamed to size, thus insuring absolute interchangeability of parts. Turned coupling bolts are used, and keys are furnished.



Complete stocks of all sizes, including odd sizes and reductions.



## W. A. JONES FOUNDRY & MACHINE CO.

CHICAGO, ILL.

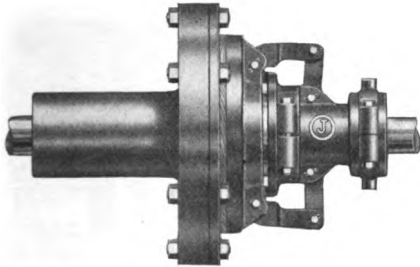
4415 W. ROOSEVELT ROAD

NEW YORK CITY

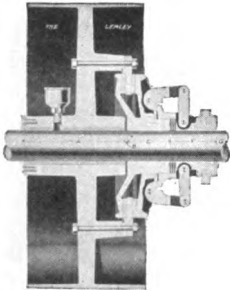
30 CHURCH ST.

**Manufacturers of Pulleys, Sprockets, Friction Clutches, Rope Drives, Cast Gears, Cut Gears, Speed Reducers and Power Transmission Machinery**

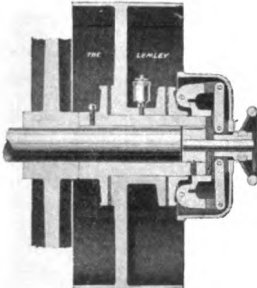
### LEMLEY FRICTION CLUTCHES:



Lemley friction clutches are simple in construction, and positive and powerful in operation. The friction surfaces may be replaced without removing the clutch from the shaft.



LEMLEY clutches are made to meet both line and counter-shaft requirements as well as for gas engine work. They will meet your highest expectations.



### JONES CUT AND CAST TOOTH GEARS:



We make a specialty of LARGE GENERATED GEARS. Every SPUR, WORM or BEVEL gear we cut is generated by the hobbing process. Our facilities for making these and planed bevel gears are of the very best. The quality of our work and our prices should interest you.

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We can furnish both the  $14\frac{1}{2}^\circ$  involute tooth, or the involute stub tooth of  $20^\circ$  pressure angle at the same relative prices. Our large stock of spur, worm and bevel gear patterns enables us to make unusually prompt delivery and will save you the cost of patterns. Send for our gear catalog No. 19 which lists about 2000 of our standard patterns for cast tooth spur, worm, bevel and miter gears.

### JONES CAST IRON MACHINE MOLDED PULLEYS:

JONES pulley service is nearly as well known as the product itself. All pulleys are accurately bored, turned and balanced, and are finished in a strictly workman-like manner.

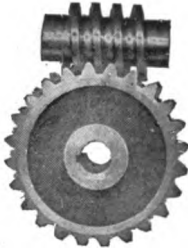


## R. D. NUTTALL COMPANY

PITTSBURGH, PA.

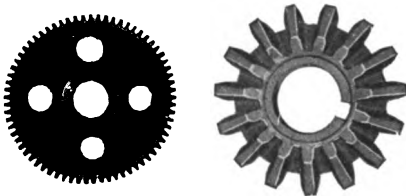
Manufacturers of Cut and Planed Gearing of Every Description

### CUT TOOTH HEAT TREATED AND UNTREATED GEARING:



Machine cut gears for every mine railway and industrial class of service.

272



Heat treated gears for every class of service.



Complete tractor transmission units or tractor gearing manufactured to specifications.

### MINE AND ELECTRIC RAILWAY TROLLEYS:

Trolley and trolley parts for mine industrial and railway applications.

### FLEXIBLE COUPLINGS:

Made in three types:

Type "A" accommodates any H. P. from 9 to 1340 and ranges in size from 5½ in. to 48 in. diameter.

Type "B" diameter ranges from 13¾ in. to 78½ in. It cares for any H. P. from 93 to 4875.

Type "C," our Safety First coupling, has all parts likely to cause injury enclosed. It ranges in size from 6½ in. to 52 in. diameter and accommodates from 83 to 2680 H. P.

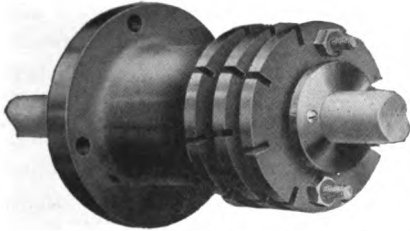


*Adjustable Shaft Bearing, Transmission Gears, Steam Jet Blowers*

## SAUER POWER GENERATING CO.

5115-19 ROSETTA ST., PITTSBURGH, PA.

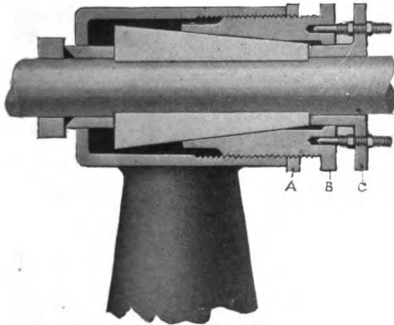
**Manufacturers of the Sauer Adjustable Shaft Bearing, the Sauer Transmission Gear, Steam Jet Blower**



### THE SAUER ADJUSTABLE SHAFT BEARING:

(Patented Dec. 10, 1907.)

SAUER ADJUSTABLE BEARINGS save power—increase profits—in every line of industry where bearings constitute a part of the plant equipment. They reduce friction losses, make possible



higher speeds and heavier feeds, thereby increasing the output, the true measure of efficiency. The Sauer Bearing is of a standard form, possessing the special advantages of simplicity of construction, easy adjustment of center and side motions while running, and the elimination of liners, oiling grooves and shaving or fitting.

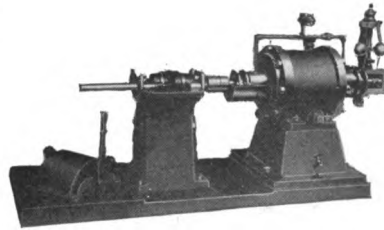
The Sauer Adjustable Shaft Bearing can be fitted to every hanger, post hanger and pillow block of a corresponding size in your plant.

The only wearing parts of the bearing are the adjustable blocks which are made either of Babbitt metal or bronze.

The Sauer Adjustable Shaft Bearing, in design, weight, durability, as well as dependability, is the most satisfactory bearing for all high speed machinery where accurate running is required; such

as in the case of Turbines, Generators, Motors, Emery and Buffing Wheels, Machine Tools, Crank Shafts, Loose Pulleys.

Write for Further Information and Prices.



### THE SAUER TRANSMISSION GEAR:

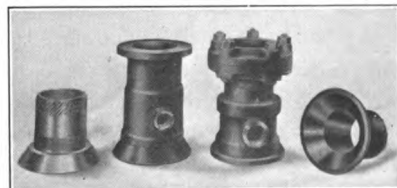
For varying the speed of turbines, motors, and practically all machinery where an increase or decrease of speed is required, the Sauer Power Generating Company furnishes a transmission gear by which the speed can be changed easily while the gears are running. The device consists of a high and a low speed shaft and one or two countershafts, the two former being in one straight line but disconnected.

It is claimed that the gear will transmit twice as much power as another gear of the same width and strength, since the power is transmitted on two sides and by twice as many teeth. Among the special features of the gear are that side and end thrust are eliminated from both the driving and the driven shafts and the gears are very compact, requiring only a small amount of space in proportion to the power transmitted.

Our engineers are at your service in solving your transmission problems.

### STEAM JET BLOWERS:

Our Steam Jet Blowers form a high degree of vacuum and can be used consequently as suction as well as for injection.



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## THE POOLE ENGRG. & MACHINE CO.

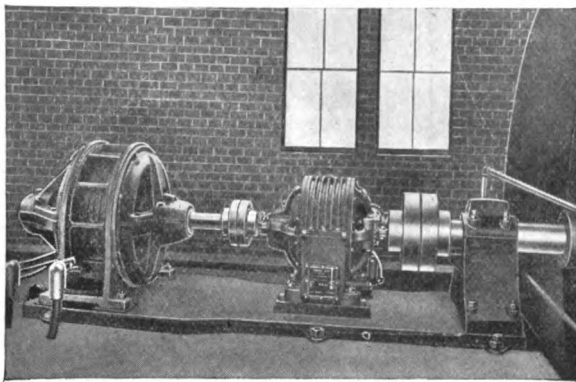
Established 1843

WOODBERRY, BALTIMORE, MD.

Manufacturers of Gears and Power Transmission Machinery

### THE TURBO-GEAR (Fast Patents):

The Internal Herringbone Turbo-Gear is a patented, self-contained, mechanical power transmission interposed between, and directly coupled to the prime mover and the driven unit. It may be used as either a step-up or step-down speed-transforming device.



200 H. P. Turbo-Gear Line Shaft Drive

### Gear Members:

The Turbo-Gear consists of a large, internal, double-helical gear made of a special-analysis, open-hearth, steel forging, heat-treated to increase its ductility and to insure uniform hardness. A double-helical pinion cut integral with the high-speed shaft, made of Halcomb-electric furnace chrome-vanadium steel heat-treated to an elastic limit of 180,000 pounds per square inch and of proper hardness to minimize wear. Intermediate double-helical gears made of high-carbon steel forgings with large bronze bearings

are mounted on hardened and ground, forged, steel shafts secured to the cast-steel, slow-speed member.

On this slow speed member, which is part of the slow-speed shaft, are mounted two heavy-duty S. K. F. Ball Bearings, one on each side of the

gears, and supported directly by the substantial housing. Thus it will be seen that the slow-speed member and shaft carrying the intermediate gears, and the high-speed shaft and pinion are independent of one another for support and yet each is supported directly by the housing. The internal gear is stationary, the moving members are the pinion and intermediate (planetary) gears.

The gear members in the Turbo-Gear are cut on a gear generator, specially designed for this purpose, that produces a true involute-shape stub tooth of unequalled accuracy and finish.

### Reliability:

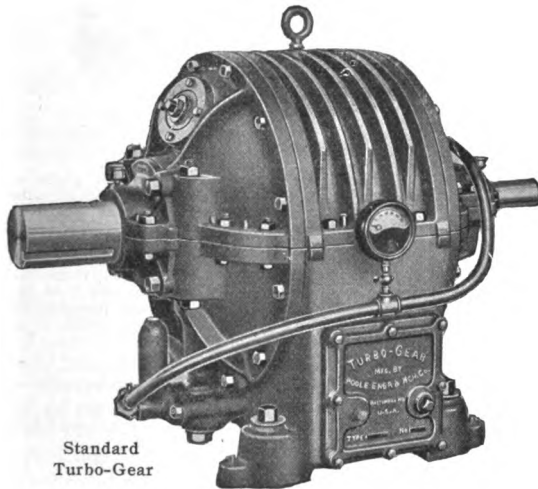
The Turbo-Gear is built for long service. It is rugged and compact yet of ample proportion with low tooth pressures to resist overloads and shocks, as well as wear.



## THE POOLE ENGRG. & MACHINE CO.

### General Application:

Speed, efficiency and safety are the watchwords of the day. The Internal Herringbone Turbo-Gear meets all these requirements. It can be successfully employed for all kinds of gear drives, and used instead of the noisy, inefficient and highly dangerous methods of transmitting power through belts, ropes and chains.



Standard  
Turbo-Gear

### *Turbo-Gears are used with:*

Motor Driven: Blowers, Centrifugal Pumps, Compressors, Conveyors, Line Shafts, Rubber Mills.

Turbine Driven: Centrifugal Pumps, Condensers, Fans, Generators, Rotary Pumps, Stokers.

Oil Engine Driven: Centrifugal Pumps,

Water Wheel Driven: Centrifugal Pumps, Exciters.

There is no type of drive which would not be made less noisy, more efficient and use less power by adopting this transmission.

### Advantages:

High efficiency (98-99%).

Safety (no belts, chains or sprockets, no exposed gears, no guards required).

Freedom from noise and vibration.

Small floor space required.

Totally enclosed (can be used in wet, dirty, dusty, gritty places).

Simplicity (sprockets, chains, pulleys, belts, hangers, bearings, extra shafting, etc., eliminated).

Reversibility (can be used to either step-up or step-down the speed) and can drive in either direction of rotation.

Low first cost (lower than a complete gear, chain or belt drive).

Low maintenance cost (practically nothing).

No side strain on shafts or bearings (pure torque transmission).

Low erection expenses.

No subsequent adjustments needed. Once properly set up always thereafter in running condition.

Large speed-reduction makes possible the use of a higher-speed, cheaper, more efficient motor.

Wider range of speed reduction than any other single-reduction form of drive.

Cool operation—sure proof of high efficiency.

All tooth pressures are balanced.

High- and low-speed shafts in axial alignment.

Each rotating member independently and directly supported by the housing.

Gears sprayed by a continuous stream of oil under pressure.

Three times as many teeth in constant contact as on any other form of Herringbone Gear drive for equal power. Consequently, low tooth pressure with corresponding increase of life.

Lighter weight per horse power than any other complete reduction gear.

### Capacity:

The Turbo-Gear can be furnished in any capacity from 2 horse power up.

## THE BALDWIN CHAIN & MFG. CO.

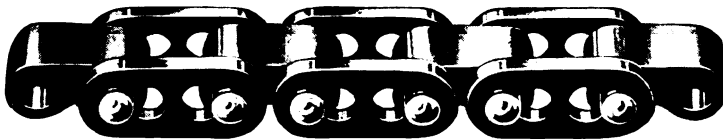
WORCESTER, MASS.

Makers of Power Transmission Chains and Sprockets

**GENUINE  
BALDWIN  
CHAINS**

**BALDWIN CHAINS** for transmission of power are made in two distinct types, block chains and roller chains.

**Block Chains:** Consist of solid steel



blocks of section resembling either the letter B or figure 8, each separate block drilled to receive two revoluble studs to which the side links are attached; also furnished in riveted type. This class of chains is adapted to comparatively light work where the lineal speed of the chain does not much exceed 800 feet per minute.

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All Baldwin Block Chains, except No. 5, are made detachable. They are as durable and as strong as the riveted chains of the same size. The value of the detachable feature of these chains is proved by the increased demand for them by the trade who find them very convenient for the ease with which they can alter the



length of a chain to suitable requirements, either for changing the gearing or for quick repairs.

**Roller Chains:** As their name indicates consist of rollers mounted upon hollow shafts technically called bushings, a pair of which is fitted in to side links to form the equivalent of the solid block used in the block chains. These built-up blocks are then connected by rivets or studs to other side links. The connection is either made permanent by riveting or made separable by using studs provided with cotter pins at one end. The fastening to be selected will depend

upon the nature of the work to which the chains are applied, or to individual preference.

This style of chain is adapted to the heaviest work and if properly lubricated is capable of standing up under a lineal speed as high as 1,200 feet per minute, or under exceptional conditions somewhat higher.

### Cotter Pin Detachable Roller Chain:

Baldwin Cotter Pin detachable chain can be easily separated at each link, and is well adapted for heavy motor trucks.

The side links on one side of the chain are riveted to the ends of the studs, and on the other side of the chain, the links are forced on to the studs, and retained by a cotter pin.

**Riveted Roller Chain:** The material used in the manufacture of these chains is carefully selected and particular attention is paid to the heat treatment given it. The neck of the rivet is a driving fit knurled and forced into the side link by power. This makes a connection that is superior for all requirements.

Baldwin machine-made roller and block chains are suited for a great variety of chain drives. It is our business to furnish estimates for chains and sprockets for various drives.

### SPROCKETS:

We have a large department equipped with the best facilities for the accurate and economical production of sprockets, in large quantities as well as for sample lots. No order is too small to interest us, or too large for us to handle.

We cut sprockets from any of those materials which appear to be



best adapted for wear in the particular work they are called upon to do.



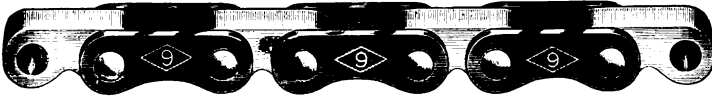
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# DIAMOND CHAIN AND MFG. CO.

INDIANAPOLIS, IND.

Makers of Diamond Chains Since 1890

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## DIAMOND CHAINS:

Diamond Chains are made in 69 Models ranging from  $\frac{1}{2}$  inch to 2 inch pitch, and from  $\frac{1}{8}$  inch to  $1\frac{1}{4}$  inch width.

## Some of their Uses:

Motor Trucks  
Farm Tractors  
Bicycles  
Motorcycles  
Cream Separators  
Textile Machinery  
Ensilage Cutters  
Automobile Starters  
Cordage Machinery  
Printing Presses  
Conveying Machinery  
Laundry Machinery  
Leather Working Machinery  
Packaging Machinery  
Paper Making Machinery  
Milling Machinery  
Mining Machinery  
Fan Drives  
Motor to Line Shaft Drives

Machine Tool Drives

Automatic Feeding Devices

And a great variety of other applications.

## Advantages:

Positive Transmission as in Gears

High Efficiency

Flexibility

Adjustable Centers

Ease of Repairing

Reliability

Economy

We guarantee our product against imperfections.

Prompt Deliveries

Write us regarding proposed chain installations. The advice of our engineers is at your service without cost to you.

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## MORSE CHAIN COMPANY

ITHACA, N. Y.

ADDRESS NEAREST OFFICE

BOSTON, MASS., 141 Milk Street  
CHICAGO, ILL., Merchants Loan and Trust Bldg.  
CLEVELAND, OHIO, 421 Engineers Bldg.  
DETROIT, MICH., 1003 Woodward Ave.  
GREENSBORO, N. C., 805 Ashboro Street  
NEW YORK CITY, 50 Church St., Hudson Term.  
Bldg.  
PITTSBURGH, PA., Westinghouse Bldg.  
SAN FRANCISCO, CAL., Monadnock Bldg.  
ATLANTA, GA., Earl F. Scott, M.E., 702 Candler  
Building

CANADA, Jones & Glasco, Reg'd, Montreal, St.  
Nicholas Bldg., Toronto, Bank of Hamilton  
Bldg.

KANSAS CITY, MO., Morse Engineering Co.,  
Finance Building

MINNEAPOLIS, MINN., Strong-Scott Mfg. Co.,  
413 Third Street, S.

ST. LOUIS, MO., Morse Engineering Co., Chemical  
Building

### Product:

#### MORSE SILENT CHAIN

99% Efficiency



Morse frictionless "Rocker Joint" Silent Chains and Sprockets—a high speed, positive, and flexible drive of many and varied applications, which maintains an efficiency of over 99% by actual test, a claim that can be made by no other manufacturer of silent chains. From  $\frac{1}{4}$  H. P. to 5,000 H. P. For High or Low Speed.

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### Difference:

The difference between the Morse Silent Chain and all other types is in that unseen and all-important part, the joint. The MORSE is constructed with the undeniable fact always in view—the joint must bear the burden of service in any chain. Instead of a single pin, as in other joints, two special pins, both seated, form the joint. No bushing is required. As the chain bends in circling each sprocket, the curved side of one pin rolls or rocks against the broad, flat side of the other, eliminating destructive sliding friction entirely. When on the straight run between sprockets, the flat sides of both pins are brought together, holding the chain steady and true.

### Speed and Service:

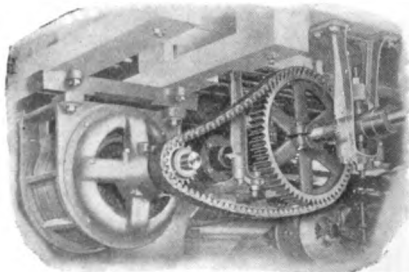
This exclusive "Rocker Joint" construction enables the MORSE to run at a speed far in excess of other chains because lubricant is not essential to its operation; and after years of experimentation (in nearly every line of industry) it is accepted as the most durable chain on the market.



### Engineering Assistance:

Our corps of engineers with years of experience in designing and installing millions of horsepower chain drives will assist you to solve your transmission problems.

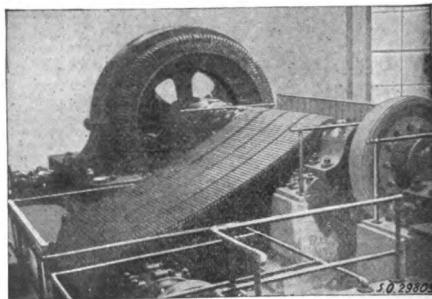
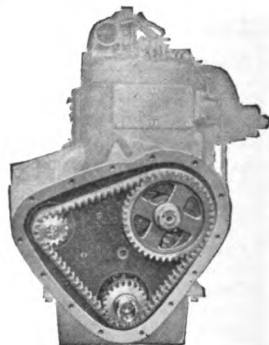
This service is rendered gratis. Get in touch with them NOW



Overhead Line Shaft Drive



The Ideal  
Drive  
for  
Motor  
Auxiliaries



The Largest Chain Drive in the World: Five thousand h. p. Morse Silent Chain Drive from water wheels to generator, Ox Bow Hydro-Electric Plant, Snake River, Copperfield, Ore.



# AMERICAN PULLEY COMPANY

4200 WISSAHICKON AVE., PHILADELPHIA

**BRANCH STORES:**

NEW YORK      BOSTON      CHICAGO      SEATTLE      SAN FRANCISCO  
33-35 Greene St.   165 Pearl St.   114-116 S. Clinton St.   536 First Ave., So.   14 Natoma St.

**Wrought Steel Belt and Sash Pulleys and Pressed Steel Shapes**

**AMERICAN**  
STEEL SPLIT  
**PULLEYS**

## Guaranteed for Double Belt Service

Repeated tests run by engineers of the highest standing have shown that American Steel Split Pulleys will transmit more power with less belt slip than cast iron, wood or other steel pulleys. Data will be furnished on application.

They are about half as heavy as cast iron pulleys, designed for equal service, and save the power required to rotate the unnecessary dead weight of the latter. It takes one horse-power to rotate each ton of weight on shafting.

Tests have shown that, where the arms of pulleys fan the air, it costs sometimes almost a dollar more per pulley per year to rotate them than it does to rotate the American Steel Split Pulley, the arms of which cut the air.

The manufacturers will coöperate with engineers wishing to arrive at the actual facts as to efficiency, putting their testing apparatus at the disposal of the inquirers.

## AMERICAN STEEL SPLIT PULLEYS

All "American" Pulleys above 6 inches in diameter have grooved faces.

Listed sizes 3" to 120" in diameter.

Crown and Straight faces.

Interchangeable bushings.

No set screws and no keyways unless for unusually heavy duty.

Stocked by over 250 dealers in the United States and Canada.

All pulleys fully guaranteed.



(Patented)

3", 4", 5" and 6" DIAMETERS

Note the sturdy construction. These small pulleys are as perfect in their way as larger "American" Pulleys. No more can be said.



(Patented)

## INTERMEDIATE SIZES

Provided with grooved air escape. Six flat "A"-braced arms (edge on) give great rigidity and least air resistance. Riveting the ends of the arms to inner flange means a round pulley, strong where strength is needed.



(Patented)

44" TO 82" DIAMETER

Larger diameters up to 120", with faces wider than 16", of similar design—with more arms and stronger hub. Grooved air escape.

**CROWN OR STRAIGHT FACE**

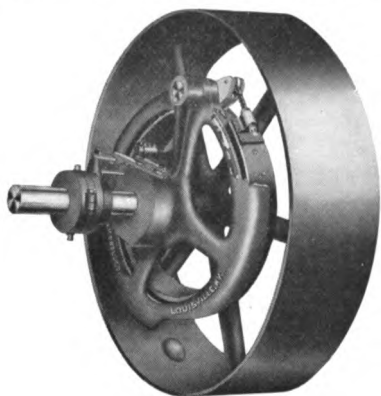
# THE W. E. CALDWELL CO.

Established 1884

340 EAST BRANDEIS ST., LOUISVILLE, KY.

Manufacturers of Friction Clutches and Power Transmission Machinery

## CALDWELL FRICTION CLUTCHES:



Caldwell Friction Clutch Pulley

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The notable features of this clutch are its simplicity, strength, ease and perfection of adjustment and freedom from breakage.

The basic principle is identical with that of the standard automobile service brake; a flexible band, lined with asbestos and tightened with a lever. In practice it has given equal service with that much used and abused device.

There are only eleven parts. All are designed to have their greatest strength in the direction of the greatest stress and all small parts are of steel.

There is only one adjustment. One screw shortens or lengthens the band and gives all the adjustment necessary. This is so simple that it can be easily and correctly maintained by anyone.

Most clutch breakages are caused by having one of several adjustments too tight and thus causing one part to carry the entire load instead of the one-fourth or one-sixth that it was designed to carry.

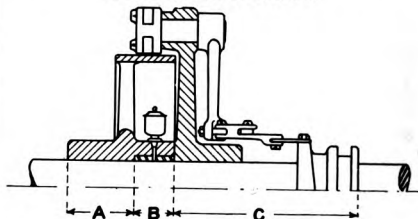
This cannot happen with the Caldwell clutch. It is therefore immune from this as well as a number of other clutch troubles.

It is easy to operate as the lever is moved by a toggle link which gives increased power as the stress increases. This and the fact that the band grips the entire circumference of the friction ring gives it great pulling power.

We furnish the Caldwell clutch in the form of friction clutch pulleys, gears, sheaves or sprockets, as cut-off couplings or with an extended hub so that a separate pulley, sheave, sprocket or gear can be attached.

When not specified we furnish a bronze tube bushing but we recommend our cast split removable phosphor bronze bushing.

## DIMENSIONS OF CALDWELL FRICTION CLUTCH COUPLINGS



Diameter of Clutch Inches	Horsepower at 1000 R. P. M.	Swings Inside of Inches	Largest Bore Inches	Space on Shaft in Inches		
				A	B	C
6	1	10 7/8	2 1/2	2 1/2	1 1/2	7 1/4
8	2	12 7/8	2 1/2	2 1/2	1 1/2	7 1/4
10	4	16	3 1/4	3 1/8	2	9 1/8
12	6	18	3 1/4	3 3/8	2	9 3/8
14	10	21	4	4	2 1/2	11 1/4
16	13	23	4	4 1/2	2 1/2	11 3/4
18	21	25 1/2	4 1/2	4 3/4	3	13 1/2
20	26	27 1/2	4 1/2	5	3	13 3/4
22	32	30 3/8	5	5 3/8	3 1/2	15 3/8
24	38	32 3/8	5	5 3/4	3 1/2	15 3/4
27	48	36 3/8	5 1/2	6	4 1/4	17 1/2
30	60	39 1/2	5 1/2	6 3/4	4 1/4	18 1/4
36	105	46 7/8	6 1/4	7 1/2	5	20 3/4
42	145	52 7/8	7 1/2	8 1/4	5	21 1/2
48	190	61 1/2	8	9	6	24
54	240	67 3/4	9	9 3/4	6	24 3/4

## FALLS CLUTCH & MACHINERY CO.

CUYAHOGA FALLS, OHIO

(SUBURB OF AKRON)

BRANCHES WITH COMPLETE STOCKS

NEW YORK, N. Y.  
206-208 Fulton St.

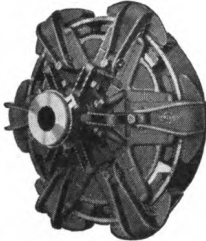
BOSTON, MASS.  
52-56 Purchase St.

CINCINNATI, O.  
134 W. Second St.

Shafting, Couplings, Collars, Bearings, Hangers, Pillow Blocks, Base Plates, Floor  
Stands, Head Shaft Hangers, Quills, Pulleys, Sheaves, Friction Clutch Pulleys, Friction  
Clutch Couplings, and a Complete Line of Power Transmission Machinery

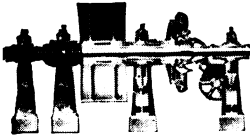
### FALLS FRICTION CLUTCHES:

Over twenty-five years ago the Falls Friction Clutch first came into prominence by meeting the demand of designers, builders and owners of electrical plants for a connection between the driving units and dynamo and generators, permitting any number of large units to be connected to the same source of power through Clutch Pulleys, Couplings and Quills.



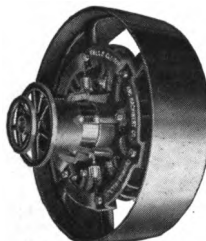
6 Arm F. C. Coupling

The next demand came in the development of the Gas Engine, requiring a rugged clutch to withstand the severe shocks of this type of power unit, allowing the machine to be started up and brought to working speed before the load is connected.



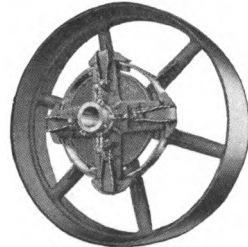
Friction Clutch Quill

Today, the Falls Friction Clutch is one of the prime factors in adapting the simplest, most efficient and most useful of power units, the Induction Motor. With a Falls Friction Clutch, Pulley or Friction Clutch Cut-off Coupling the motor can be easily started and load applied after running up to full speed eliminating the expensive equipment necessary to start the motor under full load and keeping it in its simplest and most efficient form.



Gas Engine Type  
F. C. Pulley

Throughout all these years, the Falls Friction Clutch has proven its adaptability to any and all classes of service, from low to high power requirements, and today retains its prestige as the most powerful and efficient of all Friction Clutches.

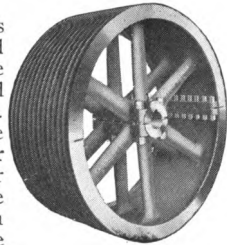


4 Arm F. C. Pulley

### ROPE DRIVES:

We are specialists in designing and equipping rope drives for any and all classes of service.

Manila Rope Drives of either American or Continuous Rope System, or English or Multiple Rope System. Wire Rope Drives and Special Sheaves.



Rope Sheave

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**CAST IRON PULLEYS** for all services, solid, split or clamp hub, double arm, heavy rims, and Fly Wheels.

**SHAFTING** of Hammered Forged Stock and standard drawn or turned.

**BEARINGS** of all types for the lightest to the heaviest service, either self-oiling, ring-oiling or grease.



Standard Iron Pulleys

We maintain an up-to-date Machine Shop, fully equipped, and have our own foundries, enabling us to specialize to your Transmission Equipment requirements.

*Engineering Corps at your service.*



# DODGE SALES & ENGINEERING CO.

Distributor of the products of

DODGE MFG. CO., MISHAWAKA, IND.

15 Branch Warehouses in the United States.

Dealers in Every Representative City

Designers and Builders of Everything for the Mechanical Transmission of Power

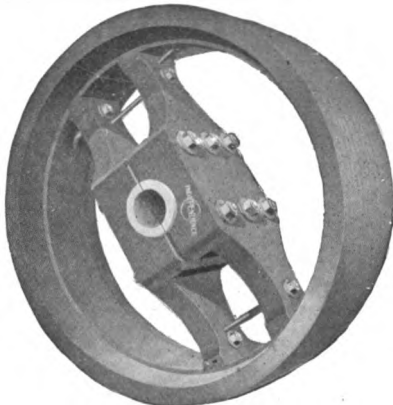
In these days when "DELIVERY" is considered of equal importance with "QUALITY," there is a double reason for your specifying "Dodge" pulleys.

DODGE PULLEYS constitute the standard of the world in design, strength, interchangeability, service and prompt delivery.

Dodge "Independence" Wood Split Pulleys are 40 per cent to 80 per cent lower in price than any pulley made from any kind of metal.

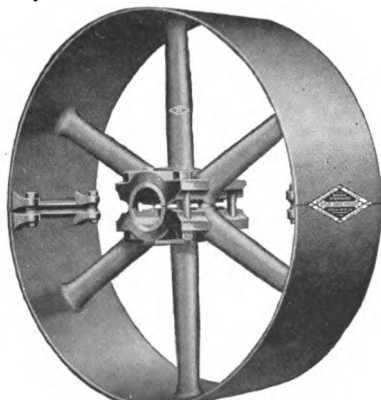
They will stand up under any double belt service and will run successfully at any practicable speed.

Dodge Wood Split Pulleys are guaranteed. If they fail in any way to satisfactorily perform the function of a stock pulley, they may be returned and full credit will be allowed.



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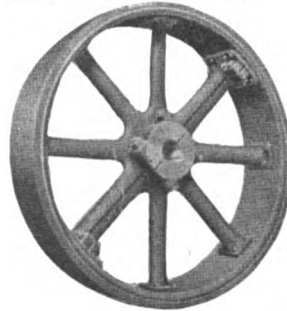
"Independence" Wood Split Pulleys are lighter, stronger, steadier, than any other pulleys of their type; they insure the maximum tractive pull of belts and are guaranteed to give satisfactory service.



The Dodge "Standard" Iron Split Pulley is America's ideal service pulley. It is easily put up or taken down, and will fit shafting of all regular sizes. There are no rivets to shear or joints to work loose.

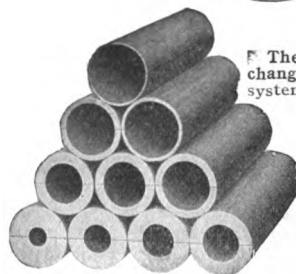
The Dodge "Standard" Iron Split Pulley is impervious to the weather, to water, to steam or acid fumes.

The Dodge "Standard" Iron Split Pulley does not become distorted under strain; it is perfectly round and gives a full 100 per cent belt contact.



Split iron center wood rim pulley—for shock loads, heavy service and high speeds.

Split Iron center wood rim pulley with double arms, especially adapted for high speed, heavy and shock loads.



The Dodge Interchangeable Bushing system makes possible the application of a pulley to any size of shaft within the range of standard bores as follows:

3" diameter	1½" bore
4" diameter	2" bore
5 to 7" diameter	2⅞" bore
8 to 23" diameter	3" bore
24 to 48" diameter	3½" bore
50 to 72" diameter	4½" bore

Bushings for Standard Iron Splits are made and finished whole, then cracked, and the fractured edges are dressed away slightly to provide for proper clamping clearance.

Two complete bushings are required for each pulley, one for each end of the pulley hub.



# DODGE SALES & ENGINEERING CO.

Distributor of the products of

DODGE STEEL PULLEY CORPORATION

Main Office: MISHAWAKA, IND.

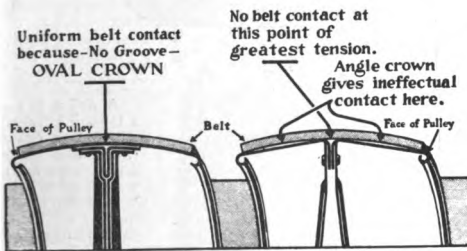
Steel Pulley Plant at ONEIDA, N. Y.

## Steel Split Pulleys

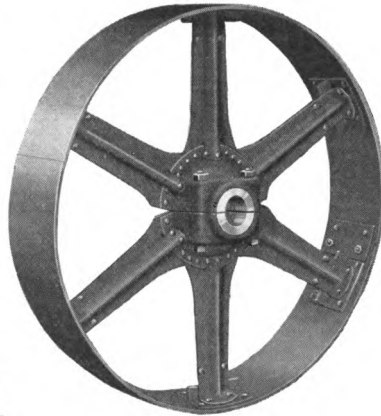
### ONEIDA AND KEYSTONE STEEL SPLIT PULLEYS:

Are now sold exclusively by the Dodge Sales and Engineering Company. The marked superiority of these steel pulleys over all similar products is at once evident to any one familiar with pulley construction.

Both Oneida and Keystone pulleys possess the true oval crown rim which makes for greater uniform belt contact, because of the absence of a groove at the point of greatest tension, such as is found in other types of steel pulleys.



Valuable literature on the subject of steel pulleys will be sent to anyone on request.



The New "Keystone" Steel Split Pulley

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Throughout the construction of both Oneida and Keystone pulleys, wherever two pieces of metal are riveted together, these metals are counter-locked male and female so that there is positively no shearing or lateral strain on the rivets.



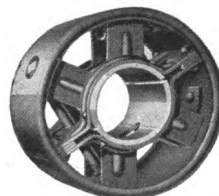
"Oneida" Steel Split Pulley

Oneida and Keystone pulleys are made in all sizes up to very large belt wheels for main engine drives.

### NATIONAL STEEL PULLEYS:

Are made in 3, 4, 5 and 6" diameters, 3" to 6" faces, and fill a long-felt want for a strong, efficient satisfactory small pulley.

The National pulley has all the advantages of the bushing system, and, being instantly available from dealer's stock, has attained wide popularity.



"National" Steel Split Pulley

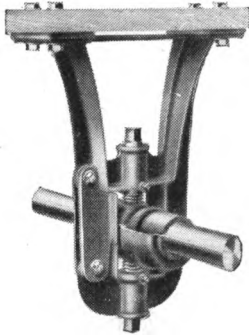
National pulleys are suitable for use on small motors, dynamos, wood or metal working machinery, and, in fact, in all places requiring small well-balanced, efficient pulleys

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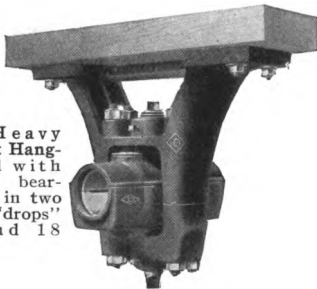
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## DODGE SALES & ENGINEERING CO.

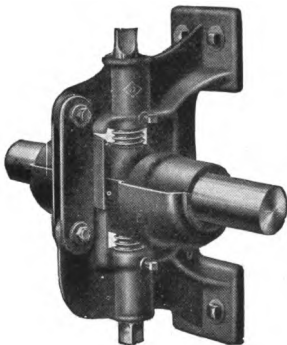
For pleasing appearance, ample strength, wide adjustability, easy erection, perfect alignment, and general mechanical quality there has never been produced an equal to the **DODGE DOUBLE BRACE, BALL-AND-SOCKET HANGER**, made in both "drop" and "post" styles.



The Dodge Drop Hanger is ball-and-socket in its fitting.



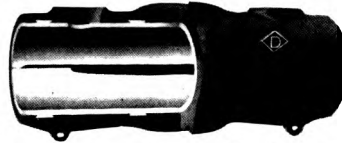
**284 Dodge Heavy Head Shaft Hangers** fitted with Ring-oiling bearing. Made in two standard "drops" of 12 and 18 inches.



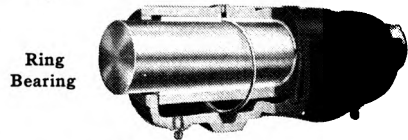
**Adjustable Ball-and-Socket Post Hanger** with Standard and Self-oiling Bearings. Ample adjustment; machined base.

Designed for the utmost strength in form and proportions, it is nevertheless of pleasing appearance in its lines of symmetry and its distribution of metal. To the mechanical eye, these features are all quite in harmony, each having its share in creating and sustaining an impression of confidence in the general excellence.

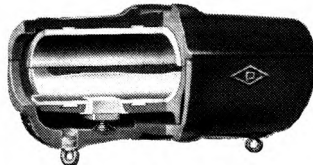
In the new Dodge Catalog the subject of hangers and bearings is discussed fully. Correct engineering tables are given as well as suggestions for a wide number of uses of hangers; pillow blocks, floor stands, etc.



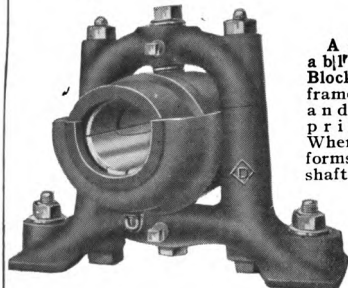
Plain Bearing



Ring Bearing

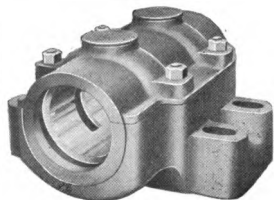


Capillary Bearing



**Adjustable Pillow Block** has open frame and ball-and-socket principle. When inverted forms a head shaft hanger.

**Capillary and Ring-oiling Rigid Pillow Blocks** adapted to the most severe service. May be ordered with dust-proof ends.



**Common Flat Box** for use under conditions where moderate powers are involved and where heavier self-oiling equipment is unnecessary.

"DODGE" BEARING METAL is intended for use under all general conditions, the "Copper Hardened" brand being better suited for places where there is considerable vibration, knock or pound to contend with.

Our "Genuine" brand is intended for use in bearings where heavy crushing strains are involved. We make a brand of metal for every service condition.

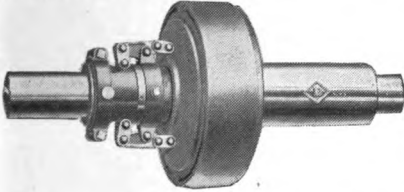


# DODGE SALES & ENGINEERING CO.

## THE DODGE SOLID FRICTION CLUTCH:

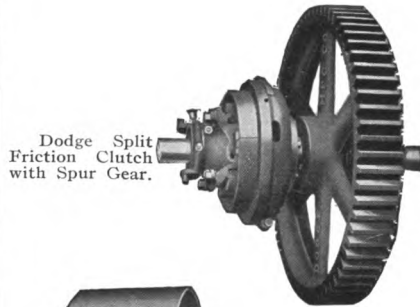
Is particularly adapted for countershaft use, and other places where a solid type of clutch can be advantageously employed, and where the power requirements are within the range of capacities offered in this style of construction.

Any kind of a pulley—wood, iron center wood rim or iron, and either solid or split—or any gear, sprocket or sheave wheel, can be used upon this clutch.

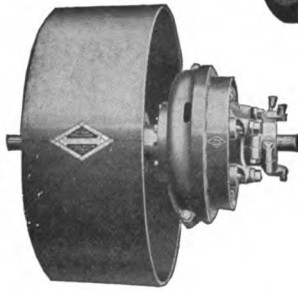


Rated Capacities of Dodge Solid Friction Clutches when Operating at Speeds Shown

Size of Clutch	REVOLUTIONS PER MINUTE																Maximum Speed	Maximum Bore	Reg. Spec.
	100	150	200	250	300	350	400	450	500										
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.			
4"	1 1/4	1 3/4	2 1/4	3 1/4	3 3/4	4 3/4	5 3/4	6 3/4	7 3/4	8 3/4	800	1 1/4"							
5"	2	3	4	5 1/2	6 1/2	7 1/2	8 1/2	9 1/2	10 1/2	11 1/2	560	1 1/2"							
6"	3	4	5 1/2	7 1/2	9 1/2	11 1/2	13 1/2	15 1/2	17 1/2	19 1/2	540	1 3/4"							
7"	4	5 1/2	7 1/2	10 1/2	13 1/2	16 1/2	19 1/2	22 1/2	25 1/2	28 1/2	520	2"							
8"	5	7 1/2	10 1/2	14 1/2	18 1/2	22 1/2	26 1/2	30 1/2	34 1/2	38 1/2	500	2 1/4"							
9"	6	9 1/2	12 1/2	16 1/2	20 1/2	24 1/2	28 1/2	32 1/2	36 1/2	40 1/2	480	2 1/2"							
10"	10	15	20	25	30	35	40	45	50	55	450	3"							
12"	15	22 1/2	30	37 1/2	45	52 1/2	60	67 1/2	75	82 1/2	400	3 1/2"							
14"	30	45	60	75	90	105	120	135	150	165	380	4"							
16"	50	75	100	125	150	175	200	225	250	275	360	4 1/2"							



Dodge Split Friction Clutch with Spur Gear.



Dodge Split Friction Clutch with Dodge Split Iron Pulley.

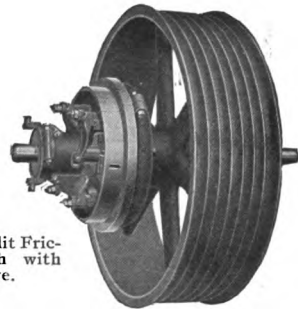
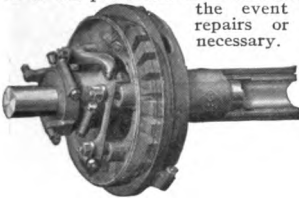
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## DODGE PATENT SPLIT FRICTION CLUTCHES:

Make possible two things of great importance and value:

(1) The easy and ready installation of the equipment upon a shaft already in place without taking down the shaft or disturbing any of the equipment upon same, and

(2) The greatest possible facility in the taking off of old parts and the substitution of new, in the event that any repairs or renewals are necessary.



Dodge Split Friction Clutch with Rope Sheave.

## THE DODGE PATENT SPLIT FRICTION CUT-OFF COUPLING:

Is used for the purpose of connecting together two sections of shafting in such way that one section can be stopped or started at will while the other section is operated continuously.

The mechanism of the Dodge Patent Split Friction Cut-Off Coupling is the same as is employed with the friction clutch for use with pulleys, gears, sheaves or sprockets. Instead, however, of the extended loose sleeve, a hub part is used, which is keyed to one of the shafts and provided with a bronze bushing for receiving the extended part of the other shaft to which is keyed the driving plate of the mechanism.

The subject of clutches is an important one and is fully described in the Dodge Book C-16, in addition to other special literature devoted to the subject. It will be sent on request.

Rated Horse Power Capacities of Dodge Split Clutches

Size of Clutch	REVOLUTIONS PER MINUTE																*Maximum Speeds		Maximum Bore
									C. I. Sleeves		Hub. Sleeves and Quills								
	100	150	200	250	300	350	400												
10	W. F. 6	H. F. 9	H. F. 12	H. F. 15	H. F. 17	H. F. 19	H. F. 20	250	450	3	2 1/2								
12	W. F. 10	H. F. 15	H. F. 20	H. F. 25	H. F. 28	H. F. 31	H. F. 34	250	440	3									
14	W. F. 15	H. F. 22 1/2	H. F. 30	H. F. 37 1/2	H. F. 42	H. F. 47	H. F. 51	280	430	3 1/4									
16	W. F. 20	H. F. 30	H. F. 40	H. F. 50	H. F. 57 1/2	H. F. 63	H. F. 68	250	420	4	3 1/4								
18	W. F. 25	H. F. 37 1/2	H. F. 50	H. F. 62 1/2	H. F. 71	H. F. 79	H. F. 85	250	410	5									
20	W. F. 30	H. F. 45	H. F. 60	H. F. 75	H. F. 85	H. F. 95	H. F. 102	250	400	6									
22	W. F. 40	H. F. 60	H. F. 80	H. F. 100	H. F. 114	H. F. 126	H. F. 137	250	390	6 1/2									
24	W. F. 50	H. F. 75	H. F. 100	H. F. 125	H. F. 142	H. F. 157	H. F. 170	280	380	7									
26	W. F. 60	H. F. 90	H. F. 120	H. F. 150	H. F. 170	H. F. 190	H. F. 205	250	360	7 1/2									
28	W. F. 80	H. F. 120	H. F. 160	H. F. 200	H. F. 225	H. F. 250	H. F. 270	250	350	8									
30	W. F. 96	H. F. 144	H. F. 192	H. F. 240	H. F. 270	H. F. 300	H. F. 324	250	325	8 1/2									
32	W. F. 128	H. F. 192	H. F. 256	H. F. 320	H. F. 360	H. F. 400	H. F. 432	250	300	9									
34	W. F. 174	H. F. 261	H. F. 348	H. F. 435	H. F. 495	H. F. 555	H. F. 594	250	275	10									
36	W. F. 243	H. F. 363	H. F. 484	H. F. 605	H. F. 685	H. F. 765	H. F. 828	250	250	11									
38	W. F. 340	H. F. 510	H. F. 680	H. F. 850	H. F. 960	H. F. 1080	H. F. 1160	250	225	12									
40	W. F. 480	H. F. 720	H. F. 960	H. F. 1200	H. F. 1350	H. F. 1500	H. F. 1600	250	225	12 1/2									

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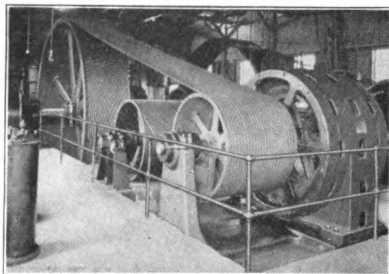
## DODGE SALES & ENGINEERING CO.

There are now in use two so-called systems of Manila rope driving—the Dodge American, or Continuous rope system, and the English, or Multiple rope system.

**THE DODGE AMERICAN SYSTEM** uses but one continuous rope, winding over all of the grooves, with the rope on the slack side forming a loop over an idler sheave and a traveling tightener, the tightener being controlled by a weight, so that it may automatically regulate the tension of all the wraps of rope.

The English system uses separate and independent, endless ropes in each groove of the wheel, depending on the weight of the ropes for tension, and pinched grooves for adhesion.

The Dodge American System is the one now most universally employed because of its much greater adaptability for a wide range of service conditions. The English system is occasionally used on certain large drives where the conditions are proper for that system.



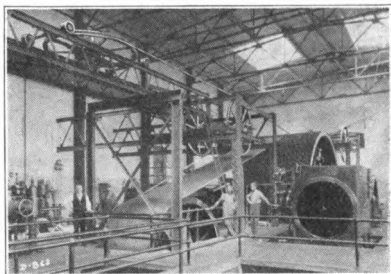
8. While it is important that in the original design of a rope drive all the details should have the attention of an experienced engineer who has specialized on that class of work, the equipment can be successfully operated and maintained by any mechanic of ordinary ability.

9. Precise alignment of shafting not necessary.

10. Lack of that extreme rigidity found in gear drives.

11. In its operation there is present that inertia, or what might be termed fly-wheel effect, which will ease off the peak and shock loads, a particularly valuable feature when motors are involved.

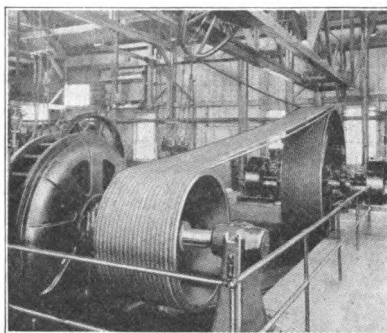
It is not possible to cover here in a complete manner the general subject of rope driving. We issue, therefore, special catalogues devoted to this method of transmitting power, which catalogues will be sent upon request.



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The advantages of transmitting power by means of rope are:

1. Distance and direction in which power is transmitted are practically unlimited.
2. Transmission of any amount of power.
3. Economy in first cost and maintenance.
4. Economy of space.
5. Positive drive, smooth running, and noiseless.
6. No electrical disturbance or loss of power by slipping.
7. Ease and simplicity of distributing power to the several floors of mill buildings, or from one building to another.



**Horsepower Capacities of Dodge American System of Rope Transmission**  
Horsepower of One Rope Based on an Arc of Contact of 180°

Rope Diameter	ROPE SPEED IN FEET PER MINUTE										
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
3/4	1.5	3.0	4.5	5.8	7.1	8.1	9.0	9.7	10.2	10.4	10.3
7/8	2.1	4.1	6.1	8.0	9.7	11.3	12.6	13.7	14.5	15.1	15.2
1	2.7	5.4	8.0	10.5	12.8	14.9	16.8	18.4	19.7	20.6	21.1
1 1/8	3.4	6.8	10.2	13.3	16.3	19.1	21.6	23.8	25.6	27.0	28.0
1 1/4	4.3	8.5	12.6	16.5	20.3	23.8	27.0	29.8	32.3	34.3	35.8
1 3/8	5.2	10.2	15.2	20.0	24.6	29.0	33.0	36.6	39.7	42.4	44.6
1 1/2	6.4	12.2	18.4	23.9	29.4	34.6	39.5	43.9	47.9	51.3	54.1
1 3/4	8.3	16.6	24.7	32.7	40.3	47.6	54.5	60.8	66.7	71.9	76.4



## THE HILL CLUTCH CO.

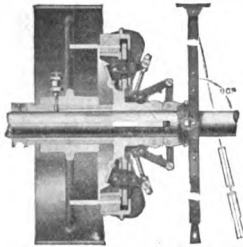
CLEVELAND, OHIO

NEW YORK SALES OFFICE, 50 CHURCH STREET

**A Complete Line of Power Transmission Machinery for Belt and Rope Drive, Including the Patented Hill Friction Clutch (Smith Type) and Collar Oiling Bearings, Special Machinery, Gray Iron Castings**

### HILL FRICTION CLUTCHES:

#### Smith Type



Sectional View Hill Clutch Pulley

(Smith Type)—(Patented)  
Built solid or split in sizes from 9 to 1300 H. P. at 100 R. P. M.

The Smith Type Hill Friction Clutch is the latest design of the well-known Standard Hill Friction Clutch which has been manufactured by us for the past thirty-five years. Vise-like jaws grip the ring in pairs, actuated

by a powerful toggle mechanism. No springs are used. Clutch is self-centering and in a cut-off coupling no alignment bushing is required, so when clutch is disengaged there are no revolving parts in contact.

In specifying Hill Friction Clutches, call for the improved Smith Type Hill Clutch to insure your obtaining the latest design and a clutch of great mechanical stability and large starting power—two essential features in successful friction clutch design.

### HILL COLLAR OILING BEARINGS:

#### Cleveland Type



Sectional View Hill Collar Oiling Bearing Cleveland Type, Patented

In the Hill Collar Oiling Bearing, instead of depending upon a loose ring or chain for conveying oil to journal, a fixed collar is employed, thus providing a positive means of elevating the oil that never fails.

In the Cleveland Type Collar Oiling Bearing oil stored in a reservoir in the bottom of the bearing is continuously elevated by a heavy split collar. Metal wipers deflect the oil which is then dis-

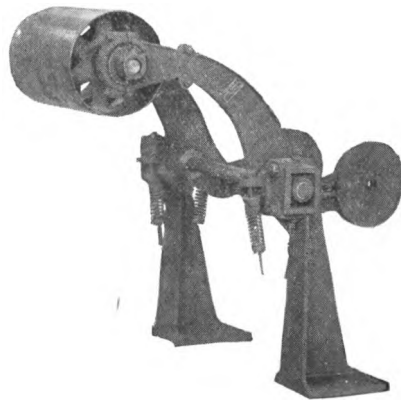
tributed along the full length of the journal.

Starting from rest two or three revolutions of the shaft are all that is necessary to completely flood the bearing and thereafter journal operates on a continuous, unbroken film of oil, eliminating wear on the babbitt and creating very high efficiency. The oil collar also acts as a thrust collar, thus eliminating the necessity of using outside shaft collars unless the end thrust is very severe.

### HILL ROPE DRIVES:

American and English Systems of Rope Drives designed, built and installed.

### HILL CLUTCH AUTOMATIC BELT TIGHTENER:



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Hill Clutch Automatic Belt Tightener  
Patent Applied For

The Hill Clutch Automatic Belt Tightener automatically takes care of the slack in belts under varying loads. It reduces belt tension and the friction load on bearings. It increases the capacity of an overloaded belt by preventing slip. It is especially good for short centers and high belt speed.

The reason for its effectiveness lies in its ability to automatically wrap the belt more or less around the pulley where slip may occur.

# THE CARLYLE JOHNSON MACHINE COMPANY

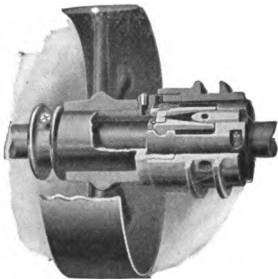
MANCHESTER, CONN., U. S. A.

Manufacturers of Friction Clutches, Cut-off Coupling Clutches,  
Marine Reverse Gears, Marine Motors

## THE JOHNSON FRICTION CLUTCH:

A Small, Compact, Light Powered Clutch for Use on the Overhead Shafting and as a Part of All Designs of Machinery

*Our Black Catalogue sent free—Write now*

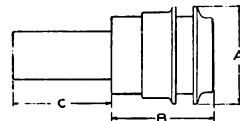


288 Section Broken Away, Showing Clutch Engaged and Pulley Mounted on Hub of Friction Cup

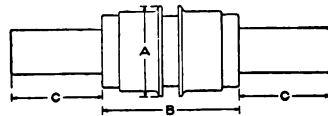
**Construction:** As seen by the illustration, this type of Clutch has but few parts and is very compact. A body fastened to the shaft carries a split ring in which are inserted a pair of levers. A curve-shaped wedge, which is made part of a shipper sleeve, forces the levers apart, expanding the ring, bringing its outer surface into frictional contact with the inner surface of the friction cup, the hub of which is made to suit requirements.

The leverage is so compounded that it requires but little pressure to operate the Clutch.

One screw which moves two taper blocks, set into the levers, adjusts the contact of the ring and cup to any tension. This is easily reached with a screwdriver, through hole in the friction cup. The perfectly smooth shipper sleeve entirely encloses these working parts so no dirt can get into them. The Double Clutch requires but little more space than the Single, and has two friction cups with hubs, on which can be mounted pulleys, cones, gears, etc., of any diameter and face.



Single Clutch



Double Clutch

## DIMENSIONS OF STANDARD SINGLE AND DOUBLE CLUTCHES

Clutch Size Number	Horse-power 100 R. P. M.	Largest Diam-eter of Clutch will Bore	Dimensions				Throw to En-gage Clutch	Weight of Standard Single Clutch	Weight of Standard Double Clutch
			A	Single B	Double B	C*			
0	$\frac{1}{2}$	$1\frac{1}{4}$ "	$3\frac{1}{4}$ "	$3\frac{1}{4}$ "	5"	3"	$\frac{1}{4}$ "	10 lbs.	20 lbs.
2	$\frac{3}{4}$	$1\frac{1}{2}$ "	$4\frac{1}{8}$ "	$4\frac{1}{8}$ "	$6\frac{1}{8}$ "	4"	$\frac{3}{8}$ "	12 lbs.	25 lbs.
4	1	$1\frac{3}{4}$ "	5"	$5\frac{1}{8}$ "	$7\frac{1}{2}$ "	$5\frac{1}{2}$ "	$\frac{1}{2}$ "	19 lbs.	32 lbs.
5	$1\frac{1}{2}$	$2\frac{1}{4}$ "	$5\frac{3}{8}$ "	$5\frac{3}{8}$ "	8"	6"	$\frac{1}{2}$ "	27 lbs.	43 lbs.
6	2	$2\frac{3}{4}$ "	$6\frac{3}{8}$ "	$6\frac{3}{8}$ "	$8\frac{3}{8}$ "	$6\frac{1}{2}$ "	1"	35 lbs.	54 lbs.
8	$2\frac{1}{2}$	$3\frac{1}{4}$ "	$6\frac{1}{2}$ "	$6\frac{1}{2}$ "	$11\frac{1}{8}$ "	$8\frac{1}{2}$ "	1"	53 lbs.	96 lbs.
10	3	$3\frac{3}{4}$ "	$7\frac{5}{8}$ "	$5\frac{1}{2}$ "	$8\frac{1}{2}$ "	$8\frac{1}{2}$ "	$\frac{3}{4}$ "	75 lbs.	110 lbs.
11	4	$3\frac{7}{8}$ "	$9\frac{1}{8}$ "	$6\frac{3}{8}$ "	$10\frac{1}{8}$ "	$8\frac{1}{2}$ "	$1\frac{1}{8}$ "	130 lbs.	150 lbs.

\* Any length of hub furnished on special order. The diameter of hub \*C is usually made from 1 to  $1\frac{1}{4}$  inches larger than the diameter of the shaft used, for standard clutches. It is usually from  $1\frac{1}{2}$  inches to  $1\frac{3}{4}$  inches larger than the diameter of the shaft used, when equipped with a self-lubricating bearing of any style.

## MEDART PATENT PULLEY COMPANY

Engineering Sales Offices  
PHILADELPHIA  
CHICAGO

ST. LOUIS, MO.

Office and Warehouse  
211 Vine Street  
CINCINNATI

Specialists, not Alone in Pulleys, but Manufacturers of Every Appliance for Use in Connection with the Mechanical Transmission of Power, Including Turned and Polished Steel Shafting

# MEDART

### LINE SHAFTING EQUIPMENT:

Founded forty years ago, with the Medart patented Steel Rim Pulley as the nucleus, our business has experienced a gradual well-planned development in the single field of making complete equipment for the mechanical transmission of power, and in building Machinery also for straightening, turning and polishing round bars of steel, bronze, copper, etc. Today the name "Medart" is synonymous with "EVERYTHING in Line Shafting Equipment," and "the best Machinery for straightening and turning round metal bars," particularly of steel.

Although common impression, due to our corporate name perhaps, has been that the name "Medart" means "Specialists in Pulleys alone," the facts are that Pulleys—every type: Cast Iron, Wood Split, and Steel Rim—constitute only a small percentage of our production, and we are importantly engaged in the manufacture of Turned and Polished Steel Shafting, Couplings, Collars, Hangers, Bearings, Bearing Supports, Friction Clutches, Gearing, Rope Sheaves, Belt Tighteners, American and English System Rope Drives and so on. In fact, we cover the mechanical transmission field, and have fully equipped some of the largest and best known plants that are noted for high efficiency.

### SHAFTING:

That we are the only exclusive Manufacturers of a complete line of power transmission machinery which manufactures shafting in our own mill, on a basis permitting us to quote Mill Prices, is something Engineers and Buyers should keep in mind when securing proposals covering tentative Line Shafting installations. Shafting in any considerable overhead equipment comprises a heavy percentage of the total tonnage involved. Hence, we are able to quote very attractively covering all Line Shafting Equipments. It will be to your great advantage to secure all your overhead equipment from one source of supply—at a saving. "Medart" Shafting is produced by the Turning and Polishing process.

### TRANSMISSION APPLIANCES:

Our Flange Couplings are all male and female design. We fit them to shafts under hydraulic pressure and afterwards face off to insure true alignment. Also we offer Compression keyed-on, Three-part Keyless, Universal Joint and Jaw Clutch type Couplings.

Our line of Hangers and Bearings and Bearing Supports includes different types, all heavy and well designed. Hanger Frames are of the 4-Way Adjustment types. Bearings are either Ring, Collar or Wick Oiling or fitted with Grease Cups—adapted for Ball and Socket or Screw Adjustment. Pillow Blocks of every style, including Base Plates, Wall Boxes, Floor Stands, Brackets, etc.

Our V-Groove type Friction Clutch, having an interchangeable Sleeve to which may be fitted either a Pulley, Gear, Sprocket or Rope Sheave, made solid or split construction, is noted for its great strength, matchless frictional power, simplicity and long life in service. Is adapted for conversion to Cut-off Coupling.

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### PULLEYS:

Our Steel Rim Pulley—light in weight, perfect in balance—is superior to any possible construction of pressed and riveted sheet steel, because stronger, stiffer, and will stay round. Made all sizes up to 16 feet diameter and 50 inches face. Our equipment for manufacture of Cast Iron Pulleys, 3 inches to 16 feet diameter, is complete from the best foundry conditions and the most modern types moulding machines to the highest efficiency in machine shop practice. Medart Wood Split Pulleys do the work—and they'll last as long as the shafting will last.

Our heavy duty "Hercules" all-steel pulley is matchless. It'll withstand successfully more abuse than any other make or construction of pulley. They are built to suit specific conditions, and guaranteed on a money-back basis.

Gears: It doesn't matter what you need in Gears—we can build them. We have thousands of patterns, and, besides, the most efficient moulding machines and gear cutting shop equipment.

Send for our General Catalog and Discounts. Let us quote your next specifications.

# THE OHIO VALLEY PULLEY WORKS

Established 1886

MAYSVILLE, KY.

Incorporated 1896

Exclusive Manufacturers of Limestone Wood Split Pulleys

## THE LIMESTONE PULLEY:

Since 1886 this company has been engaged in the exclusive manufacture of wood pulleys and the Limestone Pulley of today is the result of 33 years' experience. Many changes have been made in its construction, but always with the sole end in view of bettering our product.

**Construction:** Limestone Pulleys are constructed throughout of the best materials obtainable. All of our immense stock of carefully selected lumber is thoroughly air-dried for many months and then carefully kiln-dried.

The rims are built of sections nailed and glued. The arms are built of White Oak, sections placed edgewise to the strain and these sections increase with the width of face so that the width of spoke is always in proportion to the width of face.

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12" to 36" Diameter

The spokes are built into the rim and there firmly secured in such a manner that the strain of compression is equalized upon an extended portion of the rim.

Pulleys 37" to 83" in Diameter

are constructed in this manner; 84-inch diameter, and larger, are built with such additional arms as the diameter of the pulley makes necessary.



The Limestone is finished throughout with pure orange shellac.

## The Limestone in Diameters 3" to 5" Inclusive

is made of maple and is clamped to the shaft by heavy slotted head compression bolts accessible directly from the face of the pulley.



## Block Pulleys 6" to 11" Diameters Inclusive

are made of maple and are clamped to the shaft by compression bolts of varying size and number. These bolts are covered by a removable cap.

## Bore of Standard Pulleys:

3" Diameter.....	1 11/16"
4" to 7" Diameter, inclusive.....	2 1/2"
8" to 72" Diameter, inclusive.....	3 1/2"

One complete bushing of length required by pulley hub is furnished with each pulley without charge.

## Extra or Separate Bushings

10" or less of complete bushing.....	50 cents.
More than 10" of complete bushing, per inch.....	5 cents.

Less same discount as on pulleys.

**Special Bores**—Pulleys can be made to order with any special bore within the limits of the diameter of pulleys. For such special pulleys an additional charge is made, dependable upon the size of bore.

## Keyseating:

Prices for Keyseating Wood Pulleys.

Size of Shaft, inches	Width of Face of Pulleys			
	12 in. or less	13 to 16 inches	17 to 20 inches	21 to 24 inches
3 or less.....	\$1.25	\$1.75	\$2.35	\$3.00
3 1/8 to 3 1/2....	1.30	1.80	2.45	3.10
3 5/8 to 4.....	1.50	2.00	2.70	3.35
4 1/8 to 4 1/2....	2.00	2.50	3.00	3.50
4 5/8 to 5.....	2.35	3.00	3.70	4.35
5 1/8 to 6.....	3.00	3.75	4.50	5.35
6 1/8 to 7.....	3.75	4.50	5.25	6.10

We also make all sorts of special pulleys including taper cone, step cone, flange, rope transmission, offset hubs, extra heavy, iron center, etc.

# REEVES PULLEY COMPANY

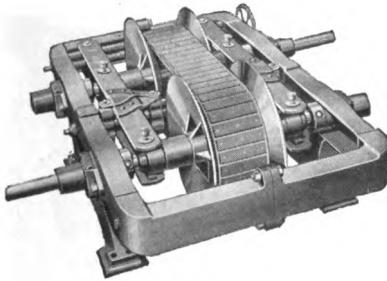
COLUMBUS, INDIANA

BRANCH HOUSE: Corner Clinton and Monroe Sts., CHICAGO

Sole Manufacturers of "The Reeves" Variable Speed Transmission, Wood Split Pulley, and Wood Split Pulley Clutch

*The Reeves*

## VARIABLE SPEED TRANSMISSION:



Solves every problem of speed variation. It is a real speed regulator—one that may be applied to any machine and any desired speed secured in a moment, without stopping, not one revolution too fast nor one revolution too slow.

The construction and operation are very simple. Two pairs of cone-faced discs are mounted on parallel shafts in such manner that they are movable. A special V-shaped belt drives from one pair of discs to the other. Two pairs of levers, operated by a right- and left-threaded screw, move the discs so that as one pair separates the other pair is brought together an equal distance, thus changing the belt to different driving diameters and increasing or diminishing the speed of the variable shaft as desired. The speed is regulated by turning a hand wheel in one direction to increase and the other to reduce the speed.

"The Reeves" Transmission is used as a counter-shaft. You belt from the line shaft or motor to one shaft, which is driven at a constant speed, and the other shaft is variable. From the variable shaft you belt to the machine to be driven.

The transmission is built in fourteen sizes to transmit from 2 H. P. to 150 H. P.; and seven classes to provide variation of 2 to 1 or as high as 10 to 1. It may hang from the ceiling, stand on the floor or be built into the machine it is to regulate.

## WOOD SPLIT PULLEYS:

"The Reeves" Wood Split Pulley is built of hardwood, select grade, thoroughly air- and kiln-dried and acclimated. Each segment glued and doubly nailed; arms are placed edgewise to the load, extending through, built up and made integral with the rim.

The arms split the air—have less air resistance or disturbance than steel. The belt adheres to the face better than to steel or iron and transmits from 20% to 30% more power with equal belt tension. 40% to 80% lighter than steel

or iron, costs from 25% to 75% less, is stronger and more efficient in operation. Built any size from 3 inches to 30 feet diameter.

"The Reeves" Wood Split Pulley should be used instead of metal ones because:

**First:** There is a saving of 50-75 per cent in weight.

**Second:** Saves money on power maintenance. Experts have demonstrated it costs \$100 per year to turn one ton of weight on a line shaft. Reeves saves 50 to 75 per cent of that.

**Third:** No defects in material possible in the laminated construction of Reeves pulleys, every piece being rigidly inspected. Can you be as sure of a cast pulley?

**Fourth:** With same belt tension they transmit 20 to 100 per cent more power than metal faced pulleys. (See Haswell's table in his "Engineers' and Mechanics' Mechanical Art.")

**Speed and Safety:** You are referred to page 323 of "Mechanical Engineer's Pocket Book," 2nd Edition, revised by Wm. A. Kent, A.M., M.E., an article on Wooden-Rim Fly-Wheels.

In comparing "The Reeves" with other Wood Split Pulleys note the following: **291**

Perfectly clear stock in arm and rim

An abundance of compression bolts, and each bolt right up against the shaft where it grips the best.

Each segment, inside and outside, double nailed and glued.

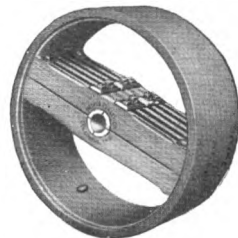
A perfectly rigid arm fastening. Arm built up with rim forming a part of same.

All stock pulleys from 6 inches to 60 inches diameter bored  $3\frac{1}{2}$  inches, thus necessitating but one stock of bushing.

Bushing made in four pieces, insuring a better bearing on the shaft—cannot shrink or swell.

Segments cut short, thus making not only a stronger rim but preventing same from getting out of true.

Each pulley finished in transparent orange shellac—as handsome as a piece of parlor furniture and will not discolor or fade when exposed to the light.



We also make Taper Cone pulleys, Step Cone pulleys, flanged pulleys and Wooden Sheave pulleys.

## T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Manufacturing Engineers, Power Transmission Machinery

### SHAFTING:



Showing Different Forms of Keyseats

We are prepared to furnish shafting of the best steel in diameters up to 24", made perfectly round and straight, thereby insuring easy running and also minimum loss of power.

### SAFETY SET COLLARS:

These are made either Solid or Split, bored to fit any size of shafting. Finished all over and fitted with hardened Set Screws. Constructed so that all bolts and Set Screws are protected by flanges projecting beyond heads and nuts. The heads of all Clamping Bolts in Split Collars are slotted.

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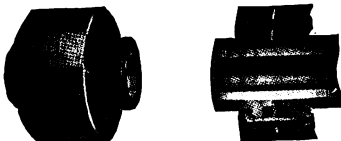


Safety Set Collars

We also supply Concealed Fast Collars forged from bar steel, bored slightly under size, shrunk on shaft, then turned and finished on shaft centers, thereby insuring a true running collar.

### COUPLINGS:

This line consists of Flange or Plate Couplings, Male and Female, or Standard Plain Face Type. Double Cone, Improved Collins and Universal Giant Compression Couplings, the latter being the Coupling that requires no keys.



Universal Giant Compression Coupling

Ribbed Compression Couplings, Shifting Jaw Clutch Couplings, either Spiral or Square Jaws, Solid Sleeve and Universal Joint Couplings.

### HANGERS:

Our line consists of many different types of Hangers all of a modern design, possessing unique adjusting and power-saving features, fitted with Ring Oiling, Chain Oiling or Plain Grease Cup Bearings.

We are also prepared to equip Hangers with Closed End Bearings and Bearings recessed for Collars. This line comprises Line Shaft, Heavy



Hanger

and Extra Heavy Head-shaft Drop Hangers, Post Hangers and Bracket Hangers, all being made in both the Ball and Socket and Four Set Screw or Peerless Type.

We also supply Adjustable Girder Clamps of a unique design, Countershaft Parts or Complete Countershafts.

### PILLOW BLOCKS, ETC.:

From our many different patterns we are prepared to supply Rigid and Adjustable Pillow Blocks suitable for operation under various conditions. This classification comprises Plain Flat Boxes, Standard Rigid, Wick, Ring and Chain Oiling Rigid Pillow Blocks and Post Hangers; Solid Journal Boxes, Ball and Socket and Four



Pillow Block

Set Screw Ring Oiling Adjustable Pillow Blocks; also Plain or Wedge Adjustable Base Plates; Cast Iron and Steel Arch Wall Frames; Cast Iron Wall Brackets, Plain and Wedge Adjustable Ball and Socket Floor Stands, and Fire Wall Sleeves.

## T. B. WOOD'S SONS COMPANY

### PULLEYS:

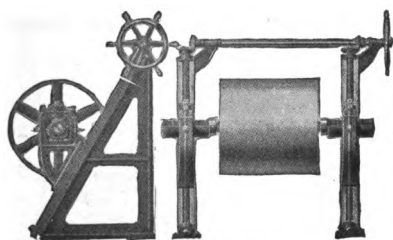
We manufacture Cast Iron Pulleys only, of a correct design having metal properly distributed, same being carefully finished and balanced. This type of pulley we believe superior to others as it is permanent and suited to a wider range of service. We are prepared to furnish Cast Iron Pulleys of every description.



Pulley

### BELT TIGHTENERS, ETC.:

This line comprises Belt Tighteners made with "A" Frames and Vertical Side Frames, all with Screw Adjustment; in addition, Rack and Pinion Tighteners

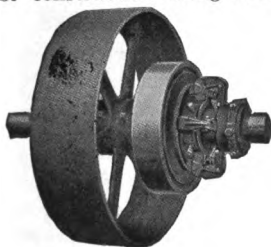


Belt Tightener

for Horizontal or Vertical use. We are also prepared to furnish Stationary and Adjustable Mule Pulley Stands, Single and Double Brace Binder Frames and Guide Pulleys.

### UNIVERSAL GIANT FRICTION CLUTCHES:

These Clutches are of the Disc Type, of a consistent design throughout and are made either solid or split, the same type of construction being used for all sizes and all speeds. The Clutch is complete within itself either for use as a cut-off coupling or for use in connection with ordinary Pulleys,



Universal Friction Clutch Pulley

Gears, Rope Sheaves, Sprockets or any regular or special part that it is desired to use as a driving or driven mechanism.

The Sleeve and Body of this Clutch being independent, both are held rigidly in lateral position upon mounting and sustain no end thrust whatever when clutch is thrown in or out of engagement. The Friction Surfaces are protected from dust, dirt and other foreign substances. If desired, Clutch may be equipped with special cover to protect mechanism.

### BELT AND CLUTCH SHIFTING MECHANISMS:

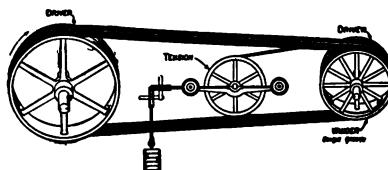


Compound Lever Shifter Stand

We supply Belt Shifters which may be attached to any of our Hangers. We also furnish for Friction Clutches, Fork and Lever Stands, Compound Levers, Worm Geared and Single or Double Spur Geared Shifter Stands.

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### ROPE TRANSMISSION:



Rope Drive

We are prepared to make complete installations of either English or American System Drives, and also to furnish Rope Sheaves with Grooves of every description; Tension Carriages, Track, Track Hangers and Tail Rope Sheaves.

We have at your command Engineers who have had years of experience in designing and installing satisfactory Rope Driving Equipments, whom we will be glad to have plan drives to meet conditions as they may exist.



# AUBURN BALL BEARING COMPANY

Established 1893

22 ELIZABETH STREET, ROCHESTER, N. Y.

Manufacturers and Engineers

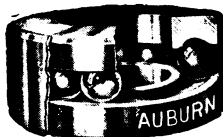
Ball Bearings for Every Service



## BALL THRUST BEARINGS:

Auburn Ball Thrust Bearings are made in standard and special designs to answer specified end thrust conditions of rotating machine parts. The Auburn Four Point Cone Contact Principle groove illustrated by our trade mark above, reduces friction and wear between balls and races. Heavy races, large balls, the best alloy tool steels, properly heat treated and accurately ground, combined with our coöperation in selecting bearings, insure the best answer to your problem.

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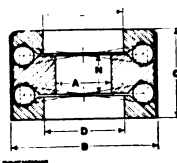
Enclosed Style T-100 Single Thrust

Auburn Enclosed Style T-100 Ball Thrust Bearing is a self-contained and protected type for use in exposed places. It is made in standard sizes from  $\frac{1}{2}$ " shaft up. Send for list of sizes.



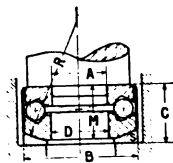
Open Style T-114 Single Thrust

Auburn Open Style T-114 Ball Thrust Bearing is a self-contained type for use inside the machine where it may operate in a bath of oil if desired. It is made in standard sizes from  $\frac{1}{8}$ " shaft up. Write for bulletin.



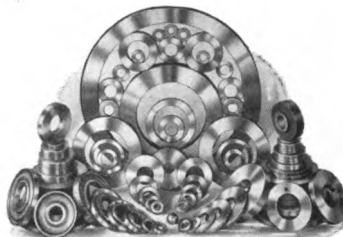
T-150

Double Thrust Aligning Thrust



T-170

When machine parts do not preserve alignment, Style T-170 Spherical Seated Thrust Bearing answers the problem. Where there is double thrust to be cared for, we provide the single unit T-150 Style bearing. When a difficult bearing problem is encountered in machinery design or operation, send us full details with sketches and get the Auburn Answer.



## Bearing Problems Answered

Bearings designed and made to meet unusual service conditions, Races, Washers and Rings of tool steel, manufactured to customer's specifications. Send Blue Print for quotation.



Steel Balls



Valve Balls

Balls of Steel, Brass, Bronze, Aluminum, Cork and other materials, solid and hollow, for bearings, tumbling barrels, valves and for special purposes. Inquiries solicited



# THE FAFNIR BEARING COMPANY

Conrad Patent Licensee

NEW BRITAIN, CONN.

DETROIT OFFICE: 752 David Whitney Bldg.

CHICAGO OFFICE: 1301 So. Michigan Ave.

## FAFNIR BALL BEARINGS:

Are manufactured in various types suitable for practically every condition of service.



Radial Bearing  
Assembled

Fafnir Radial Ball Bearings (with both single and double rows of balls) are designed to carry radial load plus a limited amount of thrust load in either direction.



Single Row  
Radial



Double Row  
Radial

Note the design and construction of the Fafnir Pressed Steel Ball Retainer, in



Fafnir  
Pressed Steel  
Retainer

which the steel fingers pass above the pitch line of the balls, facilitating the assembly of more and larger balls. The result is greater load carrying capacity.

Fafnir Angular Contact Ball Bearings are designed to carry both radial and double acting thrust loads in any proportion up to the capacity of the bearing.



Double Row  
Angular Contact

Fafnir Thrust Ball Bearings are manufactured both with and without self-



Thrust



Self-Aligning Thrust

aligning washers and seats. They may be used alone, or in conjunction with the radial type for carrying both radial and thrust loads.

Fafnir Open (Magneto) Type Ball Bearings are advantageous for high speeds and light loads, such as magneto applications.



Magneto or Open Type

All types of Fafnir Ball Bearings embody the best that is to be had in workmanship and material.



## GURNEY BALL BEARING COMPANY

Conrad Patent Licensee

JAMESTOWN, N. Y.

**Ball Bearings with Exceptionally Large Load Capacities  
Bearings of Annular Type for Combined Radial and Thrust Loads**

**All Ball Bearings Look Alike** to the casual observer.

But before selecting a ball bearing to suit his requirements, the careful engineer will investigate the inherent qualities, the degree to which the design and construction has been perfected, and determine whether the mechanical principles of the bearings are fundamentally correct. After such inquiry he will choose

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### GURNEY BALL BEARINGS

because they are built on mechanically and mathematically correct principles

because maximum load capacity per ball is obtained by virtue of the concentric and highly perfected race contour (no filling slots to weaken rings).

because the use of a maximum in number and size of balls is possible on account of the patented, unique method of assembling

because higher load capacity per bearing is obtained, due to the large number of balls used

because both radial and thrust loads can be carried on a single row of balls

because in our processes of manufacture an unequalled uniformity and accuracy is obtained by the use of automatic machinery by skilled operators

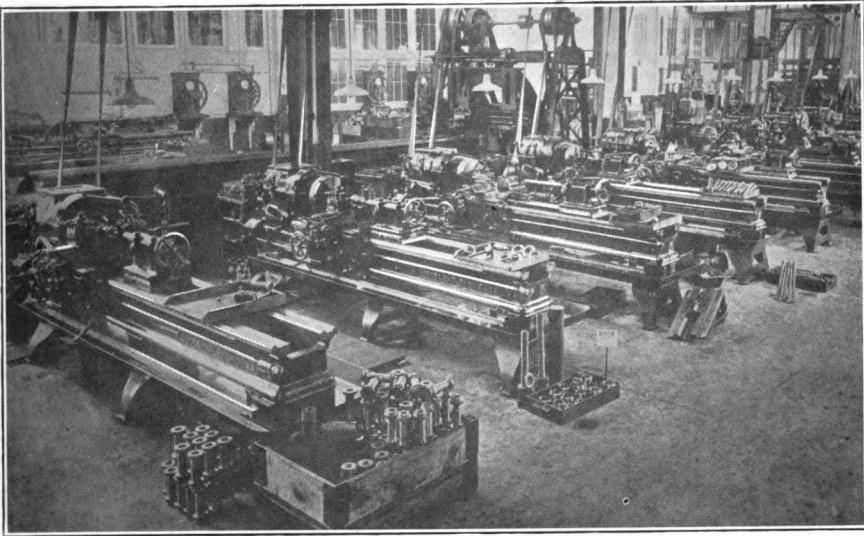
because we maintain an elaborate system of minute inspection after every operation on each part in the manufacture of Gurney Ball Bearings, and

because our Engineering Service Department is always ready to promptly render expert advice regarding proper sizes and types of bearings to use, that we can guarantee to give satisfactory service, and to design suitable mountings, oil and dirt seals, etc.

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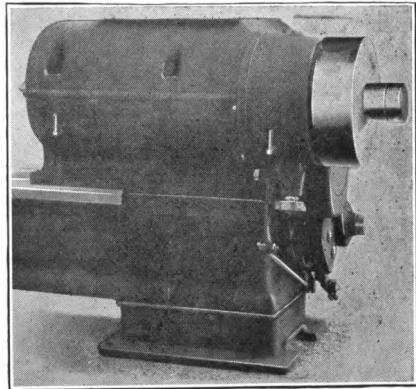
## GURNEY BALL BEARING COMPANY

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Production is the slogan of the present day. Machine Tools are wanted which can be speeded up more and more, and which can take still heavier cuts. Yet they are expected to stand up and last under increased strains, and to produce work of uniform accuracy.

The problems of carrying both radial and thrust loads, separately or in combination, as well as numerous other complicated bearing questions, are successfully answered by Gurney Engineering experience. Not only are Gurney Ball Bearings made in seven different types and each type in fifty-seven different sizes to meet various radial and thrust load requirements, but the Gurney Organization is prepared to render intelligent, efficient and co-operative Engineering Service in selecting from this total of



399 different Gurney standard bearings those that will exactly fit your requirements or suggest special sizes to fit unusual conditions.

Insure correct installation of the right kind of bearings in your machines by referring your problems to our Engineering Department.

*At your service.*



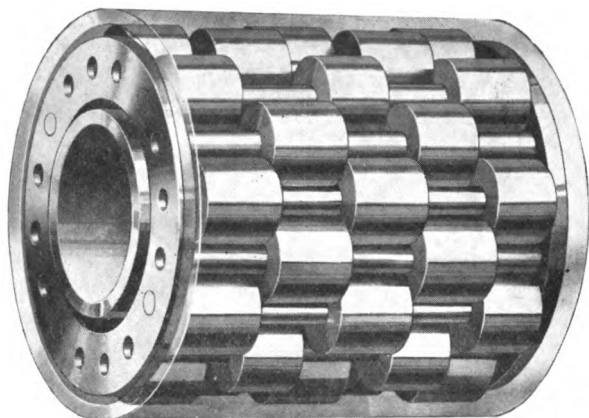
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## THE HART ROLLER BEARING CO.

ORANGE, N. J.

**Manufacturers of Roller Bearings for Use on Automobiles, Motor Trucks, Farm Tractors, Jack Shafts, Line Shafts, Counter Marine Bearings, Shafts, Textile Machinery, Concrete Machinery, Mine Cars, Ore Cars, Steel Mill Cars, Trailers, Hand Trucks and Machine Tools**

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### **HART STAGGERED ROLLER BEARINGS:**

IN THE construction of the HART ROLLER BEARING staggered rollers are substituted for those of the straight type, this arrangement permitting the use of rollers of two different widths arranged with staggered ends in assembly and meshed, thereby covering the entire surface of the shaft and outer casing. The rollers are mounted on alignment shafts supported at their ends by retainer rings, in which they revolve freely.

The staggered arrangement of the rolls effects a substantial reduction of the bearing angle and relieves the bearing of a large part of the strain to which it would otherwise be subjected.

The arrangement also provides spaces for a freer circulation of oil or grease lubricant.

In the HART ROLLER BEARING the row of rollers which is light loaded is free to rotate independently of the heavy loaded row of rollers; that is, a differential movement occurs between individual sections of a given roller, with the result that objectionable features resulting from eccentric loading of the bearing are overcome.

The HART ROLLERS are made from a special analysis alloy steel which is carefully heat-treated. The bearing parts are all precision machined and accurately ground.

THE PRINCIPLE on which HART ROLLER BEARINGS is constructed is a distinct departure from the methods now extant. The distinctive feature of the HART ROLLER BEARING is the staggered and meshed roller arrangement which gives this bearing a far greater load capacity than that of any other bearing. The rollers are so arranged that they will not form a track in either the sleeve or casing.

HART ROLLER BEARINGS are designed for light or heavy duty purposes where efficient radial bearings are desired.

We offer the coöperation of our Engineering Department to users and prospective users of HART ROLLER BEARINGS in suggesting the size and type of bearing best adapted for any particular work. To secure this coöperation, it will be necessary to furnish us blue prints, maximum and minimum loads and speeds of your problems. Such information will be held in the strictest confidence.

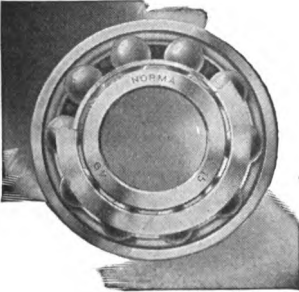
*Write for our engineering data.*

# THE NORMA COMPANY OF AMERICA

1790 BROADWAY, NEW YORK, N. Y.

"Norma" Ball, Roller, Thrust and Combination Bearings

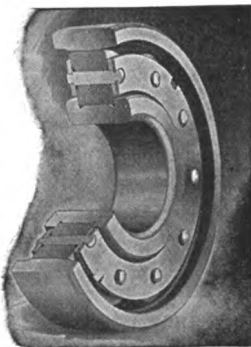
## "NORMA" BALL BEARINGS:



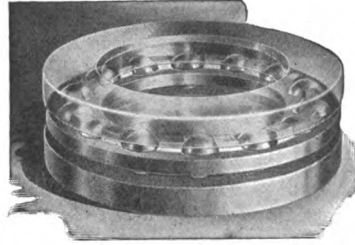
Open type, separable bearings of extremely high precision, rigidly mounted, silent running, with every element in workmanship and design contributing to high-efficiency, long-time service; notably successful in high-speed operation, being the standard bearings with most of the leading manufacturers of high-speed electrical apparatus.

## "NORMA" ROLLER BEARINGS:

Heavy-duty, high-efficiency bearings pre-eminently adapted for service where shock, jar, vibration and sudden load variations must be encountered; double the load capacity of a ball bearing of the same dimensions; temporary overload capacity up to 50 per cent of their own rating; high-speed, quiet-running units of extreme precision and maximum durability.



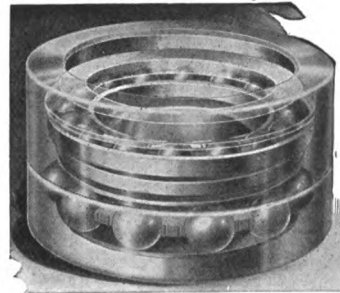
## "NORMA" THRUST BEARINGS:



Precision units affording maximum anti-friction efficiency under end-thrust loads; designed to afford long-service durability and silent-running qualities; made in several styles, single and double, both without housings and with housings of several types giving self-contained advantages.

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## "NORMA" COMBINATION BEARINGS:



Self-contained units affording perfect adjustment and maximum anti-friction efficiency under combined radial and thrust load; two types—combined annular and ball thrust, and combined roller and ball thrust; distinguished by high precision, open-type construction, rigid mounting, silent-running and high-speed qualities.



Send for the complete catalog,  
"Norma Precision Bearings."

## HYATT ROLLER BEARING CO.

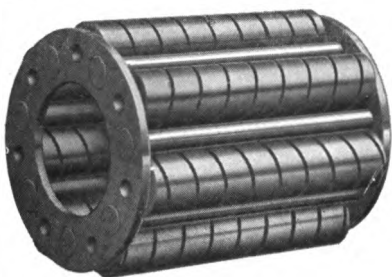
METROPOLITAN TOWER, NEW YORK CITY

**Manufacturers of Bearings for Mine Cars, Countershafts, Service Cars, Trucks of all kinds, Cranes, Trolleys and Hoists, Steel Mill Equipment, Concrete Mixers, Textile Machinery, Etc.**

The rapidly growing use of anti-friction bearings in all classes of machinery to conserve power, to cut down lubrication and attention costs and to insure dependability of operation, is a matter of especial interest to every engineer.

Eventually anti-friction bearings will entirely displace plain friction bearings as succeeding years increase the demand for more economical, more dependable operation of machinery. The gigantic wastes that have existed in our country due to its abundance of fuels and materials are being slowly but surely checked and anti-friction bearings are one of the soundest means of eliminating these wastes.

300



### HYATT ROLLER BEARINGS:

Are anti-friction bearings that merit the careful consideration of every thinking engineer, because they are designed and constructed according to sound engineering principles.

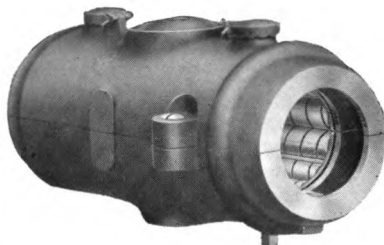
By reason of the slight flexibility of the roller, Hyatt Bearings carry the load on an area. This materially reduces the unit load and enables the surfaces of the shaft and the bearing to stand up under shock loads without permanent deformation.

The chrome-vanadium steel rollers are heat-treated to a hardness that successfully resists wear. Assembled in a cor-

rectly designed, substantial cage, they provide an anti-friction unit that is simple to apply and that is dependable and effective.

Hyatt Roller Bearings have been used for years with unvarying success in steel mill cars and roller tables, machine tools of all kinds, mine cars, conveyors, industrial trucks, textile machinery, railway service cars, cranes, trolleys and hoists, automobiles, tractors, etc.

You will find our Engineering Bulletins of interest and value to you. They contain complete designs for the application of Hyatt Roller Bearings to all classes of machines. We shall be glad to send you Bulletins covering the applications in which you are interested.



### HYATT LINE SHAFT BOX:

Hyatt Roller Bearing Line Shaft Boxes can be applied to any of these types of hanger frames:

1. 4 Point Set Screw Frame.
2. Pioneer Steel Frame.
3. Universal Giant (U. G.) Frame.
4. Ball and Socket (B. & S.) Frame.
5. J-Type Frame.

The Hyatt Box is split in two sections throughout. No elaborate change-overs are necessary to install the Boxes. Simply take out the old babbitted box and put in the Hyatt Box.

# HYATT ROLLER BEARING CO.

## HYATT ROLLER BEARING HANGERS:

The widespread need for increased efficiency in production has caused more attention to be paid to the power savings made possible by reducing the friction of moving parts of machinery. The perfection of antifriction bearings has eliminated a large percentage of the power waste caused by ordinary friction bearings.

The true rolling motion of the **HYATT ROLLER BEARING HANGERS** eliminates at least 50% of the friction that exists in plain babitted bearings, making possible a reduction of 15% of the total power. By the use of **HYATT ROLLER BEARING HANGERS** therefore, you can either increase your present equipment without enlarging your power plant or you can effect a 15% reduction in your power bill—a saving of special importance at this time.



Hyatt Line Shaft Box  
Mounted in a Standard 4-Point  
Set Screw Hanger

**HYATT ROLLER BEARING HANGERS** are made for all standard sizes of shafting and being split can be slipped into position without removing pulleys, couplings or frames. The

boxes are filled with oil after which they need not be lubricated for another four months.



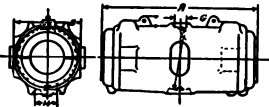
Hyatt Line Shaft Box  
Mounted on U-G Hanger

The bearing itself consists of a series of flexible rollers of chrome vanadium steel, retained in position by a substantial steel cage. Being hollow and having helical openings throughout their length, the rollers continually cover all bearing surfaces with oil.

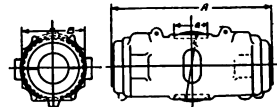
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**HYATT ROLLER BEARING HANGERS** are sturdily and accurately constructed and give satisfactory service year in and year out. There are many of them still in operation after 25 to 30 years of practical service—earning dividends through savings in power, oil and labor.

Install **HYATT ROLLER BEARINGS** in your present hangers and on all new equipment. Save power, oil and attention. Our Line Shaft Bulletin containing prices and sizes of boxes and hangers and engineering data will be of real value to you.



DIMENSIONS  
OF  
HYATT  
STANDARD  
BOXES



Either U. G. or B. & S. boxes may be used in four set screw hangers

Diam. of Shaft, Inches	Approx. Weight, Lbs.	A		B		F		G		H
		BS	UG	BS	UG	BS	UG	BS	UG	UG
1-1/8	11	8 1/4	8 1/4	3 3/4	3 3/4	3 3/4	3 3/4	1 1/4	1 1/4	1 1/4
1-1/4	14	9 1/4	9 1/4	3 3/4	3 3/4	3 3/4	4	1 1/4	1 1/4	1 1/4
1-3/8	22	10 1/2	10 1/2	4 1/4	4 1/4	4 1/4	4 1/4	2 1/2	1 3/4	2 1/4
1-1/2	27	11 1/2	11 1/2	4 1/2	4 1/2	4 1/2	5	2 1/2	1 3/4	2 1/4
2-1/8	38	13	13	5 1/2	5 1/2	5 1/2	5 1/2	3	1 3/4	2 1/4
2-1/4	46	14	14	5 1/2	5 1/2	5 1/2	6	3	1 3/4	2 1/4
2-3/8	60	15 1/4	15 1/4	6	6	6 1/4	6 1/4	3 1/4	2 1/4	2 1/4
2-1/2	67	16 1/2	16 1/2	6 1/4	6 1/4	6 1/4	6 1/4	3 1/4	2 1/4	2 1/4
3-1/8	110	17 1/4	17 1/4	7 1/4	7 1/4	7 1/4	7 1/4	3 3/4	2 1/4	2 1/4
3-1/4	182	19 1/2	...	8 1/4	...	10 1/2	...	4 5/8	...	...
3-3/8	230	20	...	8 1/2	...	10 1/2	9 5/8	4 5/8	2 3/4	3
4-1/8	280	22 1/4	22 1/4	9 1/2	8 5/8	10 1/2	10	5 1/8	2 3/4	3
4-1/4	330	24 1/2	...	10	...	10 1/2	...	6 3/8	...	...
5-1/8	380	24 3/4	...	10 3/4	...	12	...	6 3/8	...	...
5-1/4	500	30	...	12	...	12 5/8	...	6 7/8	...	...

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## THE NEW DEPARTURE MFG. CO.

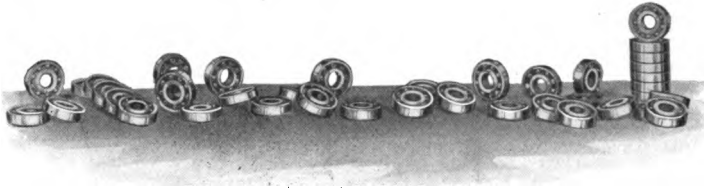
BRISTOL, CONN.

Detroit Branch  
818 Ford Bldg.

Conrad Patent Licensee

Chicago Branch  
2721 So. Michigan Ave.

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### NEW DEPARTURE BALL BEARINGS:



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New Departure ball bearings are the latest and most important improving and refining development, the advantages of which can be applied to all classes of machinery.

#### Quality Assured:

New Departure ball bearings are manufactured in a New England factory where high standards of quality have been maintained for a quarter of a century and have given the manufacturers a favorable reputation throughout the world. The sincere aim of this Company has been and is to manufacture a ball bearing approaching as closely to absolute perfection as is humanly possible. In furtherance of this attainment, a highly specialized corps of laboratorial and mechanical engineers are employed, special

machinery, exclusive processes and methods have been devised, and an inspection and testing system is in operation that is more exacting in its requirements of quality than found in almost any other industry under the sun.

Ultra-severe endurance tests are kept continually running under conditions far beyond that required of bearings in actual service and by such is the final criterion of ultimate service determined and upheld.

The development of New Departure Plants for the production of ball bearings has, within the last decade, been a most rapid and healthy growth, until, at the present time, it has become the largest ball bearing manufactory in the entire world.

The quality of New Departure bearings is further assured by the use of special chrome alloy steel, subjected to an ultra refined heat treatment, to further refine an already fine structure.



# THE NEW DEPARTURE MFG. CO.

BRISTOL, CONN.

Detroit Branch  
818 Ford Bldg.

Conrad Patent Licensee

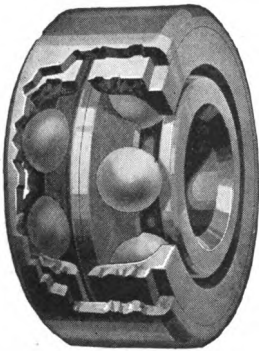
Chicago Branch  
2721 So. Michigan Ave.

## NEW DEPARTURE BALL BEARINGS:



### Double Row Type:

This bearing is the most successful two-purpose ball bearing available. The design of the bearing and the angular contact of the two rows of balls with the race-

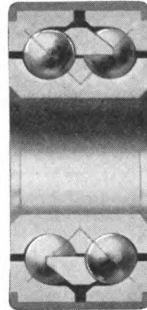


Cut Open View, Double Row

ways render this bearing **equally efficient in carrying radial loads or resisting thrust stresses from whatever direction they may come, singly or in combination.** The separator is so designed that each row of balls travels independently within its own spacing member, pockets of which are filled with lubricant, each ball rolling friction free in a film of oil. Except in those few places where only strictly radial loads and stresses occur, this bearing offers important advantages. It can be used successfully to replace combinations of single row and thrust bearings, simplifying designing, machining, assembly, and economizing installation cost.

(Continued on next pages)

Another distinctive advantage is that it offers permanently correct, non-ad-



Cross Section, Double Row

justable assembly and avoids danger of misalignment of separate members which is apt to occur when two or more separate bearings are used to do the same work. This bearing is made to standard sizes of bore and diameter, but not of width.

303

In many places the thrust stresses are very nearly if not quite equal to the radial stresses. This is particularly true in high speed mechanism where it is highly impracticable to use ball thrust washers, owing to the great centrifugal force developed. The New Departure Double Row not only provides a radial bearing of greater strength at such points, but will carry the thrust with ample margins of safety.

*Descriptive and dimensional tables with price upon application.*

(Continued from preceding pages)

## THE NEW DEPARTURE MFG. CO.

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Chicago Branch  
2721 So. Michigan Ave.

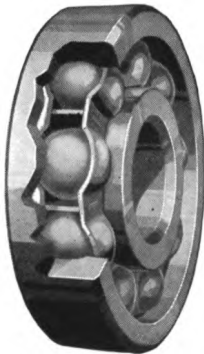
### NEW DEPARTURE BALL BEARINGS:



#### Single Row Type:

A high quality ball bearing combining best materials, workmanship, and precision of dimension with correct design for withstanding radial loads imposed

304



Cut Open View, Single Row

without friction. The largest size and number of balls possible for a given bearing are used and the ball spacer is so designed that the balls perform their work with practically no rubbing against the sides of their pockets. This bearing is made to internationally standardized dimensions.

The cup and cone are made of electric furnace high carbon chrome alloy steel, with an accurately generated curvilinear

raceway and regularly finished to limits standardized by the Society of Automotive Engineers.



Cross Section, Single Row

#### Magneto Type:

A ball bearing that most truly is built like a watch, small in size, exquisite in the precision of its every part and detail,



Cut Open View Magneto Type

and so designed as to be specially adaptable to noiseless running at high speeds.

In the making of the New Departure Magneto ball bearing, manufacturing operations are performed under ideal conditions in a plant specially equipped and devoted exclusively to the production of small bearings. All parts of a given size of this bearing will interchange readily as a matter of course.

*Descriptive and dimensional tables with price list sent upon application.*

# THE NEW DEPARTURE MFG. CO.

BRISTOL, CONN.

Detroit Branch  
818 Ford Bldg.

Conrad Patent Licensee

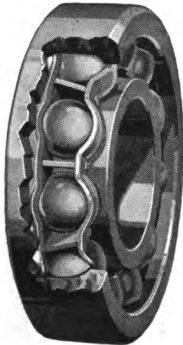
Chicago Branch  
2721 So. Michigan Ave.

## NEW DEPARTURE BALL BEARINGS:



### Radax Type:

This bearing is capable of carrying radial loads and taking one-direction thrust stresses. The point of contact



Cut Open View  
Radax Type

of balls and races is at  $11^\circ$  degrees, thus making the radial and thrust capacities practically equal. The cup and cone are separable but the use of a retaining spring in the cup permits the handling or the housing of the bearing as a unit. The separator simulates the perfected single row type which allows maximum number of balls to the bearing. The same standards of quality that are applied to the manufacture, inspection and test of the two bearings named above, obtain in this product also.

Generally when bearings of this type are used, a second Radax bearing should be reversely mounted to absorb the internal axial or thrust forces. Such a mounting gives the effect of one Double Row bearing except that the space between the races of the balls may be fixed by the designer.



Cross Section  
Radax Type

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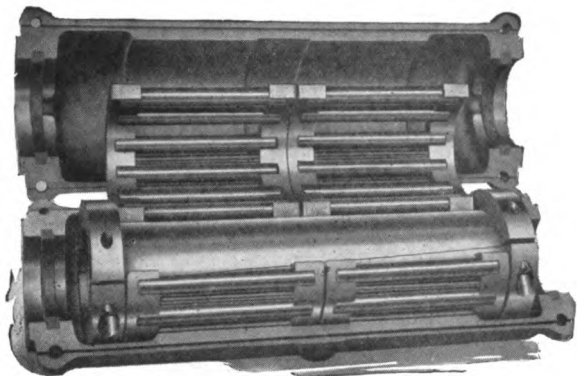
*The application of ball bearings to various uses has ever been of the keenest interest to the engineers of The New Departure Mfg. Company. Constant and painstaking study, not only of the latest developments of those branches of industry most benefited by power saving and efficient running machinery particularly qualify our organization to advise and collaborate regarding designs, which service is always freely and promptly at the command of clients.*

*Descriptive and dimensional tables with price list sent upon application.*

## ROYERSFORD FOUNDRY AND MACHINE CO.

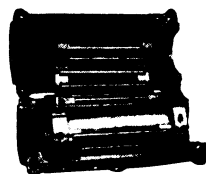
52 N. 5TH ST., PHILADELPHIA, PA.

Manufacturers of Roller Bearings and Other Power Transmission Machinery



Double Structure—Heavy Duty Type

*Known and used  
the world over.*



Single Roller Structure

### OLD RELIABLE "SELLS."

306

"Sells" Roller Bearings can be used wherever there's a hanger. On post hangers, drop hangers, or pillow blocks, "Sells" can be adapted without the expense and inconvenience of taking down the shafting, and removing the pulleys, couplings or collars.

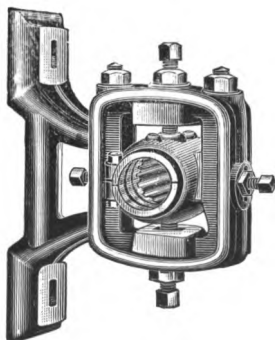
The split principle of "Sells" makes the work of installing extremely simple. They can be installed over night.

Note in the two illustrations above, the split steel bushing that prevents wearing of shaft; the collars that clamp it securely to the protected shaft.

See the split roller structure; how it separates the rollers, preventing roller-against-roller friction. It holds

the rollers parallel to the shafting and each other. Friction is obviously eliminated at every point because the bearing is of the full floating type.

We guarantee a reduction in friction load of from 25%



The "Sells" Roller  
Bearing Post Hanger

to 50%. That means greater efficiency from coal, current costs are decreased, and lubricating bills are cut in half through the use of "Sells" Roller Bearings.



The "Sells" Roller Bearing Drop Hanger

Hundreds of concerns are making these savings. Let us give you specific instances with figures and signatures.

# ROYERSFORD FOUNDRY AND MACHINE CO.

## "SELLS" ROLLER BEARING BOXES with Single Roller Structure for Line Shafts

Size of shaft, inches	Price	Length of box, inches	Width of box, inches	Height of box, inches
*Ibex 1 1/8 & 1	\$3.00	6 3/8	2 1/8	2 3/4
Ice 1 1/8 & 1 1/4	3.50	6 1/8	3	3 3/8
Idea 1 1/8 & 1 1/2	4.00	7 1/8	3 3/8	3 1/2
Idiot 1 1/8 & 1 3/4	4.75	8	3 3/4	4 1/8
Idol 1 1/8 & 2	5.50	8 3/8	3 1/8	4 1/4
Ignite 2 1/8 & 2 1/4	6.75	9 3/4	4 1/2	4 7/8
Ilk 2 1/8 & 2 1/2	7.75	10 1/8	4 3/4	5 1/8
Image 2 1/8 & 2 3/4	9.50	10 5/8	5 1/8	5 1/8
Imbibe 2 1/8 & 3	11.25	11	5 1/2	5 1/8
Immerse 3 1/8 & 3 1/4	17.25	11 7/8	5 1/8	6 3/8
Impose 3 1/8 & 3 1/2	19.25	12 3/8	6 1/8	6 1/2
Imposter 3 1/8 & 3 3/4	33.50	14 7/8	6 1/8	7 1/4
Improve 3 1/8 & 4	38.50	15	7 1/8	7 3/4
Inapt 4 1/8 & 4 1/4	44.00	15 7/8	7 3/4	8 1/8
Inca 4 1/8 & 4 1/2	50.00	16 1/4	8	8 1/2
Incense 4 1/8 & 4 3/4	56.50	16 1/2	8 1/2	8 7/8
Income 4 1/8 & 5	64.00	17	8 1/8	9 1/8

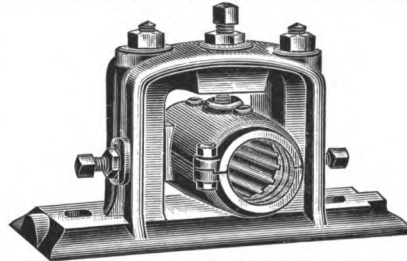
\*These words are code words and refer to box taking size of shaft above which they are placed.

## ROLLERINE:

Compo und ed  
expressly for the  
lubrication of  
"Sells" Roller  
Bearings or any  
roller and ball  
bearings. "Roll-  
erine" contains no  
wax, talc, soap-  
stone, resin, resin  
oil or any other  
gum of high frictional properties. When  
used to lubricate "Sells" Bearings, "Roll-  
erine" gives maximum efficiency.



Write for free sample.



The "Sells" Roller Bearing Pillow Block

## HEAVY DUTY "SELLS" ROLLER BEARING BOXES with Double Roller Structures for Main or Jack Shafts and Heavy Belt Pulls

Size of shaft, inches	Price	Length of box, inches	Width of box, inches	Height of box, inches
*Impound 1 1/8 & 2	\$ 9.50	13	3 1/8	4 1/2
Imprint 2 1/8 & 2 1/4	11.75	13 3/4	4 1/2	4 7/8
Inarch 2 1/8 & 2 1/2	13.25	14 3/8	4 3/4	5 1/8
Inborn 2 1/8 & 2 3/4	16.25	15 1/4	5 1/8	5 1/8
Inbred 2 1/8 & 3	19.50	15 7/8	5 1/2	5 1/8
Inclose 3 1/8 & 3 1/4	29.50	17 1/8	5 1/8	6 3/8
Incog 3 1/8 & 3 1/2	33.00	17 1/8	6 1/8	6 1/2
Indeed 3 1/8 & 3 3/4	47.00	19 1/8	6 1/8	7 1/4
Indent 3 1/8 & 4	55.00	19 3/4	7 1/8	8
Index 4 1/8 & 4 1/4	63.00	21	7 1/8	8 1/2
Indigo 4 1/8 & 4 1/2	70.00	21 3/4	8	8 1/2
Induce 4 1/8 & 4 3/4	80.50	22 3/8	8 1/2	8 7/8
Infant 4 1/8 & 5	89.50	24	8 1/8	9 3/8
Increase 5 1/8 & 5 1/2	115.00	24 3/4	9 3/8	10
Incrout 5 1/8 & 6	158.00	26 1/2	10 1/4	10 3/4

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THE "SELLS" OIL-AND GREASE GUN:  
affords the most efficient means for apply-  
ing "Rollerine" to "Sells" Roller Bearings.  
It is also adapted for heavy oils and greases  
of all kinds.

The hand wheel operating a pinion  
meshing in the rack makes it easy to  
control the amount of lubricant forced  
out. Its economy is very apparent. A  
curved nozzle adds to the convenience in  
applying the lubricant.



"Sells" Oil-and-Grease Gun

## **S K F INDUSTRIES,**

**INCORPORATED**

**165 BROADWAY, NEW YORK CITY**

**BOSTON  
PHILADELPHIA  
ATLANTA**

**BUFFALO  
CLEVELAND  
DETROIT**

**CINCINNATI  
CHICAGO  
SAN FRANCISCO**

**Manufacturers of Self-Aligning Radial, Adapter, and Thrust Ball Bearings and Shaft Hangers; Deep Groove Ball Bearings; Pillow Blocks; and Steel Balls**

Appreciating the timeliness of intensive engineering research in developing improved anti-friction bearings, S K F Industries, Inc., takes this opportunity of offering its hearty coöperation. It has been instituted as a scientific organization for the study of frictional problems with the intention

- of setting on foot a thorough and scientific study of friction and the application of more improved anti-friction bearings;
- of offering to American manufacturers in every line, a bearing engineering service designed to investigate any manufacturer's bearing difficulties and offer advice as to bearings exactly adapted to his specific needs; and
- of endeavoring through the bearing knowledge developed in this manner and through its scientific investigations to be of assistance to the entire bearing industry in the improvement not only of design but also of methods of application.

308

In the service thus made available, the engineer has at his disposal the combined resources of manufacturers of broad experience in bearing problems.

To those who have known the service rendered by the individual organizations marketing the Hess-Bright deep groove type of bearing, the S K F self-aligning type and the Atlas brand of steel balls—a massing of this experience and technical abilities will insure engineering coöperation of a practical and impartial character.

American manufacturers are invited to avail themselves of this bearing service at any time.

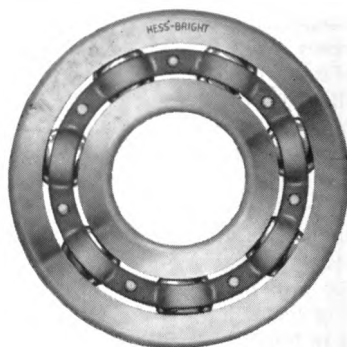
### **HESS-BRIGHT BALL BEARINGS:**

**H-B Radial Bearings** are made under the Conrad patent and are characterized

by an uninterrupted deep groove type of construction. This design gives them exceptional load carrying capacities in heavy service accompanied by shocks and considerable thrust load. The heavy rings of continuous uniform cross-section are susceptible of extreme accuracy in manufacturing and maintained accuracy in service. As the cross-section of the raceway is approximately U-shaped, the raceway possesses great power of resistance against any possible distortion caused by the balls supporting the load.

Deep grooves produce the maximum possible carrying capacity of balls and raceways without the increase of internal friction.

The depth of grooves together with the uninterrupted raceways permits this type of bearing to accept thrust loads amounting to a high percentage of the radial capacity.



**Hess-Bright Deep Groove Type  
Radial Ball Bearing**

The design, method of assembly, and quality of material and workmanship

## **S K F INDUSTRIES,**

**INCORPORATED**

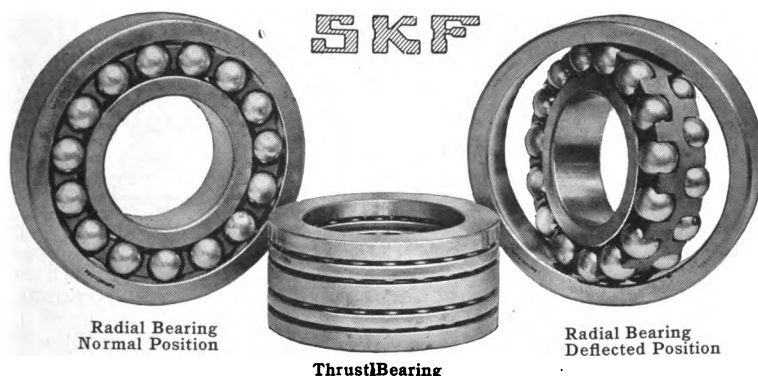
**165 BROADWAY, NEW YORK CITY**

**BOSTON  
PHILADELPHIA  
ATLANTA**

**BUFFALO  
CLEVELAND  
DETROIT**

**CINCINNATI  
CHICAGO  
SAN FRANCISCO**

**Manufacturers of Self-Aligning Radial, Adapter, and Thrust Ball Bearings and Shaft Hangers; Deep Groove Ball Bearings; Pillow Blocks; and Steel Balls**



Radial Bearing  
Normal Position

Thrust Bearing

Radial Bearing  
Deflected Position

employed have resulted in a bearing of reliability as proved by the many successful applications.

### **S K F BALL BEARINGS:**

**S K F Radial Bearings** possess the exclusive feature of self-alignment within the bearing itself so that regardless of whether the shaft is deflected or is out of alignment it turns freely.

Two rows of balls with the radial load always equally distributed on both rows under all conditions of service make it possible to fully utilize the large number of balls employed. The cross-section of the outer raceway is such that the balls

are supported at the heaviest section of the ring.

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The rolling friction of the S K F type is a minimum. The friction is less than any other type of bearing under all speed and load conditions. This is of particular importance in high speed applications.

**S K F Thrust Bearings** are made in a single or double thrust type. Either may be provided with flat seat or aligning seat and washer. They are employed wherever heavy and continuous thrust loads must be supported and can under no circumstances be used to sustain radial loads.

An exclusive S K F type is the self-contained, self-aligning double thrust bearing. Since the design of this bearing is such that the parts adjust themselves freely to any degree of misalignment occurring under operating conditions, the load is always distributed equally over all the balls.

Mounting is made simple since there is only one part to handle. The accurate and costly machining required is also greatly reduced and in case of disassembly the bearing can be readily reassembled without danger of distributing the original adjustment of the parts.

**S K F Power Transmission Equipment** consists of the self-aligning adapter bearing with mountings for supporting shafting. In it are incorporated the same



**S K F Shaft Hanger**

(Continued on next page)

## Ball Bearings and Steel Balls

(Continued from preceding pages)

### S K F INDUSTRIES, INCORPORATED

165 BROADWAY, NEW YORK CITY

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ATLANTA

BUFFALO  
CLEVELAND  
DETROIT

CINCINNATI  
CHICAGO  
SAN FRANCISCO

**Manufacturers of Self-Aligning Radial, Adapter, and Thrust Ball Bearings and Shaft Hangers; Deep Groove Ball Bearings; Pillow Blocks; and Steel Balls**

desirable features possessed by the S K F radial bearing. To mount it no machining of the shaft is necessary. The bore of the inner race is tapered and fits on a conical split sleeve. This sleeve is simply slipped over the shaft; the bearing is drawn in place on it and a lock nut holds the bearing firmly in position on the shaft. The bearing adapts itself to shaft deflections and misalignment and allows the shaft to turn freely without binding strains or cramping the balls.

#### ATLAS STEEL BALLS:

310 **Atlas Balls** are manufactured under the most rigid standards and by the best process of known manufacture. Extreme care is used in selecting the material for the balls. The steel must be of uniform composition, structure and toughness. It must be free from imperfections and be susceptible to highly developed methods of heat treatment.

Skilled workmanship and a high degree of accuracy are maintained at all times. Thorough and careful inspection after every operation in the process of manufacture maintains the specified standards and eliminates all defective material.

The necessity for this care and precision in manufacture is not generally appreciated. The limits of tolerance are



TRADE MARK

much smaller than are generally considered feasible and the finish of the surface of the balls must be of the highest. Grinding or polishing marks that may be detected by the naked eye immediately condemn the ball. The higher the surface finish, the better the endurance of the ball. Apparently flawless ball surfaces show up under the microscope as fine scratches, pittings and even gash-like defects according to the care devoted to the final operations. Surface polish alone will not do as it is but the final touch applied to truly ground shapes.

The balls approach as nearly as possible true spheres. Moreover, the allowable variation from ball to ball in a given size is extremely small. Atlas balls are made as true as it is mechanically possible and commercially practicable to realize. They are guaranteed to be accurate and true to size both in diameter and sphericity to within the one ten-thousandth part of any inch.



Carton in which Atlas Steel Balls are Packed and Sealed



# TRANSMISSION BALL BEARING COMPANY, INC.

BUFFALO, N. Y.

BRANCH HOUSES

NEW YORK CITY CHICAGO CLEVELAND PHILADELPHIA CAMBRIDGE, MASS. GREENVILLE, S. C.

Manufacturers of the Chapman Ball Bearing for Lineshafting

## THE CHAPMAN BALL BEARING:

Is designed essentially for lineshafting and is not an incidental adaptation of the ordinary ball bearing to that purpose.

During the seventeen years devoted to their manufacture, Chapman Ball Bearings have been able to save 15 to 40% of the total power in every instance.

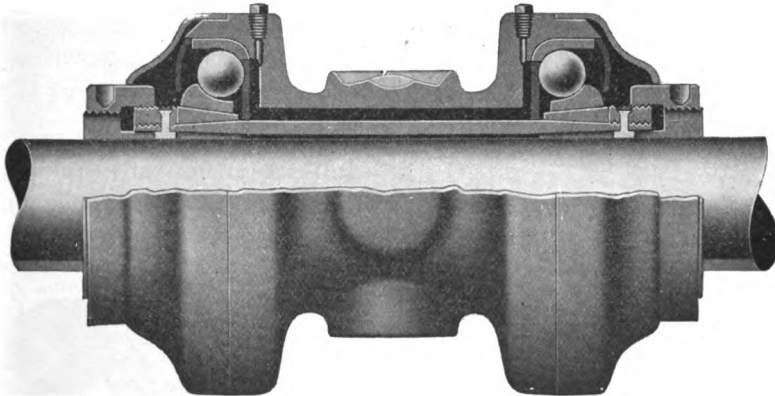
Balls of the best chrome alloy steel accurately ground to .0001 of an inch are used in a double row.

Heavy raceways of special steel correctly constructed provide a frictionless roadbed, and afford the greatest possible

The Chapman is a mechanically correct self-aligning bearing. This is an essential feature; as otherwise any departure from true alignment would lead to excessive wear and friction.

Before shipment every Chapman Ball Bearing is subjected to a severe running test under a load and speed much greater than will be met with in actual service, and is then dissembled and carefully inspected before shipping.

Rigid inspection of all raw materials and of parts in process of manufacture is also carefully enforced. The bearings are amply lubricated so as to give from six to twelve months' service without



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support for the balls. The load is taken at an angle of about 20° from the vertical, thus permitting a percentage of thrust load in either direction, in addition to its radial load. Particular attention has been given to strength and rigidity. The factor of safety provided is far in excess of the load-carrying capacity of the shaft.

There are no moving parts in contact with the shaft. Split tapered sleeve wedges lock the bearing firmly to the shaft, thereby preventing any scoring or wearing.

They are strictly drip-proof, and are impervious to dust or dirt.

further attention, after which a slight application of grease once or twice a year will suffice under normal conditions.

They are designed to fit any standard adjustable hanger frame, interchanging with babbitted bearings of same shaft size, thereby greatly simplifying a change-over job.

The unequalled service which Chapman Ball Bearings have delivered for seventeen years proves that their use in the 4000 "Chapmanized" plants is justified.

Catalog No. 3 K giving full details of construction and manner of installation will be sent on request.

## STANDARD ROLLER BEARING CO.

PHILADELPHIA, PA.

### BRANCH SALES OFFICES

DETROIT, MICH., 936 Woodward Ave.  
CHICAGO, ILL., 1806 S. Michigan Ave.  
INDIANAPOLIS, IND., 646 N. Meridian St.  
NEW YORK CITY, 1737 Broadway

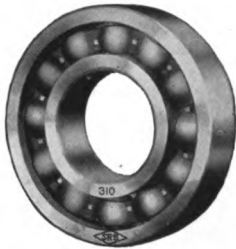
BOSTON, MASS., 84 Brookline Ave.  
CINCINNATI, OHIO, 813 Race St.  
CLEVELAND, OHIO, 2062 Euclid Ave.  
ST. LOUIS, MO., 3126 Locust St.

SAN FRANCISCO, CAL., 41 Spear St.

**Manufacturers of S. R. B. Maximum Silent Type Annular Ball Bearings (Single Row and Double Row), S. R. B. Improved Type Taper Roller Bearings, "Standard Chrome Alloy" Steel Balls, Rudge-Whitworth Detachable Wire Wheels**

### S. R. B. ANNULAR BALL BEARINGS:

It is a fact and has been proven by conclusive tests for strength and endurance that **S. R. B. Bearings** are superior to any bearings made in America.



312

There are three fundamental principles upon which we base this claim of superiority, namely:

1st. Accuracy of chemical composition of the steel used in their manufacture.

2nd. Accuracy of heat treatment which produces the correct physical structure in the steel.

3rd. Accuracy of mechanical execution in the grinding and fitting of all the component parts.

We stand ready to prove these assertions.

**S. R. B. Maximum Silent Type Annular Ball Bearings** are so called because no other name is so appropriately descriptive; maximum, because they contain the greatest number of balls possible to put into a bearing of this type; silent, because they are positively noiseless.

They are capable of sustaining greater thrust loads than other annular ball

bearings because of four specific points of merit in their design and workmanship:

1st. Deep ball groove in races.

2nd. Large diameter balls.

3rd. Maximum number of balls.

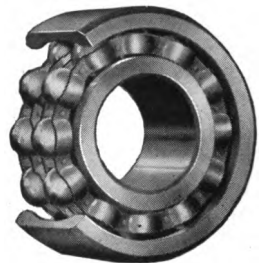
4th. Accurate and compact fitting assembly.

**S. R. B. Bearings** are interchangeable with all other makes of annular ball bearings, either domestic or foreign; comparative table (form 9032) showing the most commonly used sizes will be sent upon request.

It has been frequently demonstrated that under some conditions one type of bearing works a tremendous saving over another. Certain other conditions sometimes develop

which make one type of bearing impracticable for the use intended. Under certain load conditions, a

smaller bearing can be used very often with the same satisfaction and service as the larger one. Sometimes by making a slight change in application, according to the bearing maker's point of view, greater efficiency can be obtained.

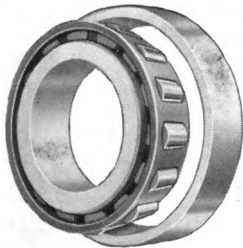


## STANDARD ROLLER BEARING CO.

You will find us always ready to solve such problems without bias and without charge, and we particularly urge the importance of consulting our Engineering Department in selecting bearings for any mounting. You will find our engineers qualified by training and experience to give expert advice on such problems, and by submitting your plans to us, sending if possible blueprints or sketches showing the application and giving complete information regarding speed, load and shaft size, you can be assured that most satisfactory results will be obtained.

**S. R. B. Bearings** are made to do their work with masterful efficiency.

### **S. R. B. Improved Type Taper Roller Bearing:**



We have designed, tested and are now manufacturing Taper Roller Bearings in accordance with an improved scheme of construction

representing a radical departure as regards shape of rollers and cone from the design of any bearing which has so far appeared on the market. This improved bearing possesses these advantages:

1. The parts are simpler to manufacture so that they can be gauged very accurately and all the component parts of the bearing are more nearly interchangeable than it has before been considered possible to make.

2. When constructed of the same quality of steel as the same size bearing of a competitor's manufacture, the new design will display four times the endurance and life which the other designs can yield. But when constructed of our superior analysis and correctly heat-

treated steels, the load-sustaining capacity of our new design bearing is still further improved.

3. This improved bearing while under load requires the application of one-quarter or one-fifth the torque to set the bearing spinning. This is also an indication of the relative frictional resistance of the new and old type bearings.

4. The primary elements of this improved type bearing are of such liberal design and the rollers and cone being contained as one unit, thus attaining simplicity of adjustment, that it commends itself to all who desire to avoid common bearing troubles, resulting in putting a bearing out of commission long before wear or abuse would have brought total incapacity.

### **"STANDARD CHROME ALLOY" 313 STEEL BALLS:**

The increasing use of steel balls for anti-friction bearings has created a demand for balls of the greatest crushing strength combined with durability and great accuracy. After exhaustive investigations on the subject of alloy steels and the effects of various heat treatments on such steels, we are offering our Standard Chrome Alloy Steel Balls, which by actual tests **have been shown to have a crushing strength approximately  $33\frac{1}{3}\%$  greater than that of the best foreign balls of equal size.** Standard Chrome Alloy Balls are made from a special chrome alloy steel, made exclusively for us and particularly adapted for the service to which these balls are subjected. The greatest care is exercised in the various processes of manufacture, including the heat treatment and inspection. Standard Chrome Alloy Balls are gauged three times as to their accuracy in diameter and sphericity before shipment, and are guaranteed to have a commercial accuracy of within .0001". Their surfaces are absolutely free from any tool marks or flaws in material.

## U. S. BALL BEARING MFG. CO.

(Conrad Patent Licensee)

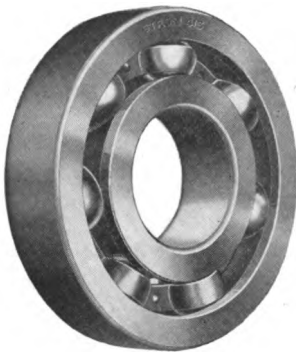
PALMER ST. AND KOLMAR AVE., CHICAGO, ILL.

Manufacturers of Strom Bearings



### BALL BEARINGS:

*of all types and sizes to operate under any condition of load and speed.*



314

### STROM Radial Bearings, Deep Groove Type:

Made in any size for light, medium or heavy duty; with deep groove ball races accurately formed, in which large sized balls, separated by a light and sturdy retainer, roll true with the least friction. They are especially adapted above all others to sustain large radial loads under severe operating conditions. They are capable of resisting end thrust loads equal to 50% of their available radial capacity.

### STROM Angular Contact Bearings:

Made in the same sizes and interchangeable with the radial bearings. They are of similar construction to the radial

bearings, being especially designed to support combinations of radial and heavy end thrust loads acting in one direction. They have an end thrust capacity equal to 150% of their available radial capacity.

### STROM Thrust Bearings:

Made in all types and sizes with flat and grooved races to meet all conditions of speed and thrust loads acting in one or two directions, and compensating for misalignment. They are of the same typical sturdy construction for which STROM bearings are noted and are especially adapted to sustain exceptionally large thrust loads.

### Engineering Service:

Our Engineering Department comprises a staff of ball bearing experts, and is always at your service. It is our desire that if at any time they may be of service to you, and help you to solve your bearing problems, you will feel at liberty to call upon them.

*Any of the following publications gladly furnished on request:*

STROM BEARINGS catalogue.

STROM BEARINGS S. A. E. Data Sheets.

Lubrication of Ball Bearings pamphlet.

Limits and Allowances on Shafts and Housings.

Calculating Bearing Loads.

Bulletins on Special Applications.

## THE S. S. WHITE DENTAL MFG. CO.

5-7-9 UNION SQUARE WEST, NEW YORK CITY

### Flexible Shafting

#### S. S. WHITE FLEXIBLE SHAFTS:

The flexible shaft is universally recognized as the most practical means, so far brought forward, for extending the application of transmitted power "around corners" and for transmitting power at angles and in positions inaccessible to rigid shafts.

It is because of these essential advantages that flexible shafting comes to play such an important part in every field of power mechanism. Instances of

to provide proper tension. The ends of the shafts are brazed to secure the tension on the wires and they are reinforced to afford a concentric attachment. This reinforcement also provides protection at the spot where the strain of work would tell first.

The widespread use of S. S. White Flexible Shafting is the direct result of making every shaft the best possible and exactly suited for the work it is intended to do.

Our research and development experience we can assert with definite accuracy is not approached by any other manufacturer. In scores of instances, our Flexible Shaft Division has worked in collaboration with inventors, designing special shafts which are proving their efficiency in actual service.

Such service is at your disposal if you are interested in the solution of any mechanical problem, which involves the

315

proof are the die-sinker equipments—the dental engine arm—the speedometer shaft—the automobile governor, with various applications to aircraft production and numerous labor-saving machines and scientific devices.

S. S. White Flexible Shafts have been made for half a century. "The standard of quality" is a tribute paid our shafts by users rather than a phrase of our own making. Thousands of S. S. W. die-sinker equipments are reducing production costs by increasing the work and saving the time of mechanics in factories everywhere. Our flexible shafting has proved most efficient in all tests for such uses as a speedometer driver.

S. S. White Flexible Shafting is made in two styles—MONOCOIL and MULTI-COIL. Special steel wires are wound

principles of complicated transmission. After we have had opportunity to experiment we will gladly show you how flexible shafting can be applied practically to your device, or advise you frankly against its use. Correspondence solicited.

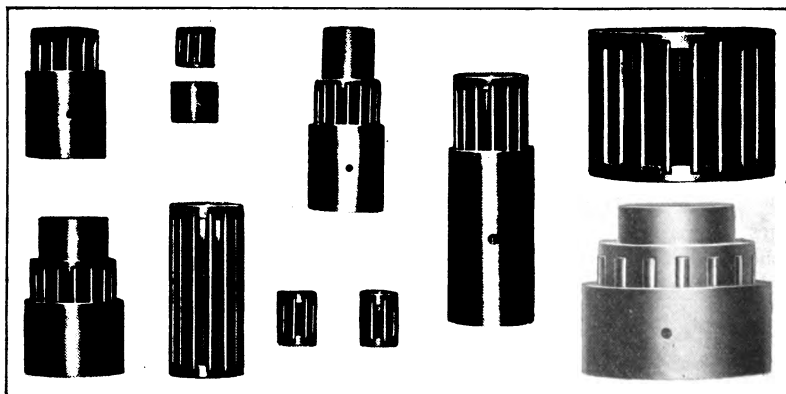
**FLEXIBLE SHAFT DIVISION**

## THE GWILLIAM COMPANY

NEW YORK: 253 W. 58TH ST. AT BROADWAY

PHONE: CIRCLE 4176

**Ball and Roller Bearings, All Types**



### JOURNAL ROLLER BEARINGS:

316

**Heavy Duty      Light Duty**

**with or without casings and sleeves**

**Furnished in standard sizes or to your  
own specifications.**

### THRUST BEARINGS:

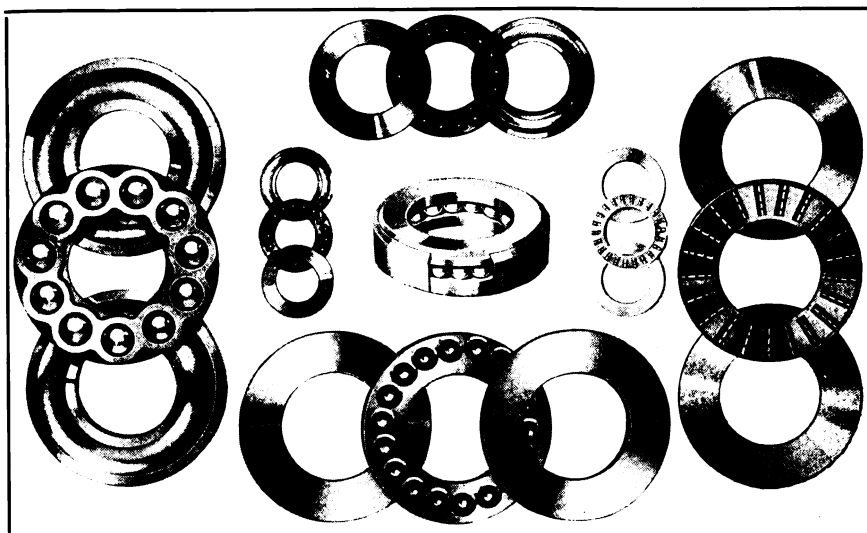
**BALL AND ROLLER**

**Standard Dimensions**

**or to Order**

**Inch or Metric Sizes**

*Write for Bulletins giving details.*



# THE GWILLIAM COMPANY

Sole Manufacturers and Distributors for the U. S. A.

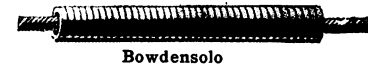
NEW YORK: 253 WEST 58TH ST.

## Bowden Wire Mechanism

### BOWDEN WIRE MECHANISM:

Consists mainly of two parts, a closely coiled and practically incompressible spiral wire forming a FLEXIBLE TUBE termed the OUTER MEMBER and a practically inextensible wire cable threaded through the above and termed the INNER MEMBER.

**What It Does:** The Bowden Wire Mechanism dispenses with complicated angle rods, levers, etc., while enabling a BACK and FORTH motion to be transmitted regardless of curves or direction. It is complete when the inner member is anchored to the operating lever at one end and to the object to be moved at the other.



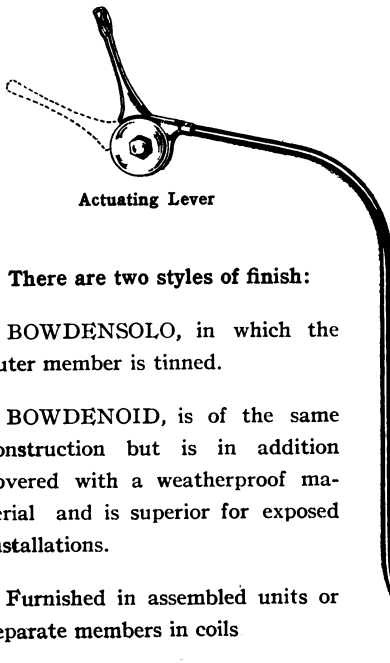
Bowdensolo



Bowdenite

OUTER MEMBER				INNER MEMBER
(Order by Number)		Approximate Dimensions of Bowdensolo		(Order by Size)
Bowdenoid	Bowden-solo	Bore	Outside	Diameter
11	31	.095	.165	1/16
12	32	.123	.193	5/64
13	33	.141	.223	1/8 or 7/64
14	34	.171	.253	9/64
15	35	.193	.288	11/64
16	36	.225	.320	3/16
51	71	.066	.136	1/27 or 1/32
	300	.087	.182	
	301	.186	.250	
	302	.250	.320	
	303	.250	.332	
	304	.234	.316	

317



Actuating Lever

There are two styles of finish:

**BOWDENSOLO**, in which the outer member is tinned.

**BOWDENOID**, is of the same construction but is in addition covered with a weatherproof material and is superior for exposed installations.

Furnished in assembled units or separate members in coils

This end →  
fixed to mechanism to be operated.

### A TYPICAL ASSEMBLY

### ADAPTED TO:

- Aircraft controls
- Motorcycle controls
- Motor boat controls
- Locking devices
- Brakes
- Magneto controls
- Carburetor controls
- Many mechanical devices requiring remote control.

# DETROIT OAK BELTING CO.

DETROIT, MICH.

ATLANTA, GA.  
1518 Hurt Bldg.

AGENTS THROUGHOUT  
UNITED STATES

CLEVELAND, O.  
4 Wade Bldg.

Manufacturers of Leather Belting

## FIRST QUALITY—OAK TANNED— REGULAR CEMENT:

Center portion only of high grade belting butts tanned to our own specifications. Made for general heavy service.



Single 16 to 18 oz. Double 29 to 33 oz. Extra heavy double 34 to 36 oz. 3 ply 46 to 48 oz.

Double thickness  $\frac{3}{8}$ " to  $\frac{7}{8}$ ". 3 ply  $\frac{9}{16}$ " to  $\frac{5}{8}$ ".

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**Medium weight.** Recommended for general high speed service where heavy



belt is not required.

Single 14 to 15½ oz.

Double 26 to 28 oz. 3 ply 42 to 45 oz. Double thickness  $\frac{1}{8}$ " to  $\frac{11}{32}$ ". 3 ply about  $\frac{1}{2}$ " thick.

**Light weight.** Recommended for small pulleys.



Reg. U. S. Pat. Office

Single 12 to 13½ oz. Double 22 to 25 oz.

Double thickness  $\frac{1}{4}$ " to  $\frac{9}{32}$ ".

Used principally in double not over 12" wide.

## SECOND QUALITY—OAK TANNED— REGULAR CEMENT:

SHORT LAP, moderate price belting made of selected side stock carefully stretched and curried.

Heavy



Medium

Light

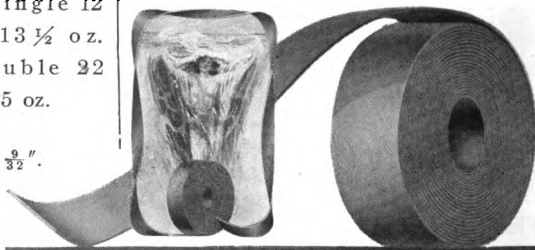


## "NAIAD"—FIRST QUALITY—WATER PROOF:

GUARANTEED



Reg. U. S. Pat. Office  
ALL WEIGHTS  
AND SIZES





# DURYEA MANUFACTURING COMPANY

MAIN OFFICE AND FACTORY: BAYONNE, N. J., U. S. A.

## BRANCHES

BOSTON, MASS.

MEMPHIS, TENN.

CHICAGO, ILL.

NEW YORK, N. Y.

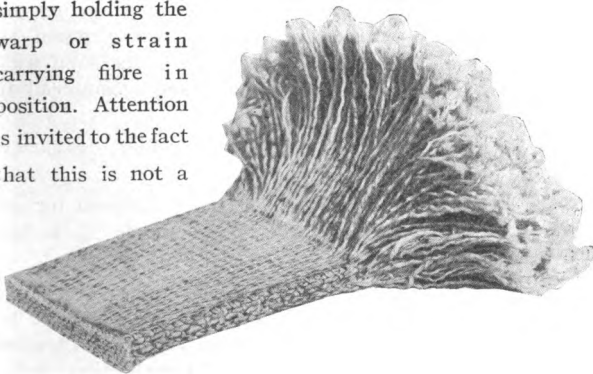
Agents in All Parts of the World

## SOLE MAKERS OF



## CONSTRUCTION:

We illustrate the woven structure showing that the entire body portion of "WOOSTER" Belting is designed to carry its proportion of transmission tension. There is no dead weight of cotton, the transverse or woof yarn simply holding the warp or strain carrying fibre in position. Attention is invited to the fact that this is not a



canvas or ply construction; there are no laps, plies, stitches or cemented parts, the weave being one solid, continuous piece of fabric, made of specially selected, long-fibre, warp twisted yarn, woven under a uniform high tension, insuring evenness, uniformity and strength.

## IMPREGNATION:

The woven body is impregnated with our patented asphalt compound by

special process, rendering the finished product practically proof against destructive elements. The treatment also provides a frictional surface, increasing the power transmission capacity and allowing the belt to carry a given load without excess wear on shaft and pulley bearings. The process of treatment also provides lubrication for the woven structure under torsional strain.

"WOOSTER" Belting is suitable for both transmission and conveyor service and, where efficiency is considered, will prove more economical under a greater variety of conditions than any one particular make of belt.

Our service engineers are at your disposal and we invite coöperation.

## ALSO SOLE MANUFACTURERS OF

"SOLVOL" BOILER COMPOUND.

"DURCO" WOOD PRESERVATIVE.

"DETERGINE" TYPE WASH.

"DURCO" COMMERCIAL TURPENTINE.

"ARMORITE" WATERPROOF PAINT.

"WOOSTER" BELT DRESSING.

319

# THE B. F. GOODRICH RUBBER CO.

AKRON, OHIO

Offices in all Principal Cities

Manufacturers of Mechanical Rubber Goods, Tires, Etc.

## TRANSMISSION BELTING:

Goodrich belting is famous for its weave of duck, minimum of stretch in service and careful construction throughout. We recommend the following grades: "COMMANDER" Friction surface, gum cushion under first ply, extra quality for extreme service conditions.

"PILGRIM"—regular rubber covered, heavy duck, good friction and cover, for general service.

"MARATHON." A friction service belt of highest quality, built on special woven light flexible duck; for small pulley high speed work.

320 "ROB ROY" and "SIGNAL" Belts, excellent for light drives such as Agricultural Work.

"OILFIELD STITCHED" for all conditions of service in oil fields.

## CONVEYOR BELTING:

For conveying ore, coal, and heavy abrasive materials. We have given much time to the development of a duck of maximum strength and extreme flexibility, a strong friction, and an edge armored against chafing, in every foot of conveyor belt we manufacture. We especially recommend:

"LONGLIFE" for severe service, where extreme wear and economy are desired.

"SUPER-LONGLIFE," the conveyor belt having the "brute strength" to stand up under the most destructive kinds of service.

"MAXECON," for ordinary service, medium in price, but reliable and serviceable.

"COSSETTE" Belting, of exceptionally high quality throughout for handling cossettes in beet sugar factories.



"WHITECOVER" Canning Belt. Special white sanitary cover for food canning factories.

"GRADER BELTING." We recommend "MAXECON" with  $\frac{1}{32}$  or  $\frac{1}{16}$  top cover.

## GRAIN ELEVATOR BELTING:

For this purpose we offer the following: "CARIGRAIN," a quality carrier belt, specially developed for grain elevator service, after a long thorough study of the service requirements.

"LEGRAIN"—the companion of "CARIGRAIN" for bucket leg service.

## ELEVATOR BELTS:

For mines and quarries. Must have a duck of extra strength, quality and weight to resist the tensile strain and action of the bucket bolts. We use a special heavy duck and recommend the following belts:

"AKRON" Elevator Belt; designed for hard duty anywhere.

"COST CUTTER," designed for general conditions, and stands up to hard service.

"NEW MINING" Elevator Belt. Special high grade for most severe service, recommended for mine elevators. Furnished with either friction surface or highest grade brown cover.

## GOODRICH AXLE LIGHTING BELTS:

Specially built for the severest service; electric train lighting from the car axle.

## POLISHING BELTS:

Sometimes called Emery Belts, built on specially strong fabric with high quality tough friction.

Our experts will be glad at any time to co-operate on any kind of Rubber Belting proposition.

# THE GRATON & KNIGHT MFG. CO.

WORCESTER, MASS., U. S. A.

**Oak Leather Tanners, Makers of Leather Belting and Leather Products**

Atlanta	Chicago	Detroit	Kansas City	New Orleans	New York
Boston	Cleveland	Fall River	Minneapolis	Montreal, Can.	Philadelphia
Pittsburgh	Seattle	Portland, Ore.	St. Louis	London, Eng.	
Graton & Knight Mfg. Co. of Texas, Dallas, Texas			Graton & Knight Mfg. Co. of Wisconsin, Milwaukee, Wis.		

Graton & Knight Mfg. Co. of California,  
San Francisco, Cal.  
Distributors in all Principal Cities

Power transmission requirements are confined to a few classes. There's a G & K Standardized Leather Belt for every class. That is the standardized Series idea—each belt is made for the work to be done.

## FIRST QUALITY BRANDS:



**Heart:** For heavy loads and high speeds where an extra heavy first quality belt is necessary.



**GraKnight:** For use where a medium weight first quality belt is required such as on main and counter drives under ordinary conditions.



**GraKnight Dynamo:** For use on high speed machines such as motors, dynamos, fans, blowers and other drives where small pulleys are used and loads are not excessive.

## SPECIAL BRANDS:



**Spartan:** A heatproof, steamproof, waterproof, unusually flexible belt, possessing great gripping power. It is especially adapted for hard drives and for use where unfavorable conditions exist.



321

**Neptune:** For use where belts are subjected to rain, dampness and other unfavorable conditions. It's waterproof.



**Spar Oak:** For use on heavy duty drives with tight, loose, flange or step cone pulleys and where the edges of the belt are subjected to the injurious effect of shipper fingers.

We also manufacture Round and Twist Leather Belting. Lace Leather cut and in sides. Washers, Packings and Valve Leathers. Belt Cements and Dressings. Strapping and Leather Specialties.

**Write for catalog, and booklet on Standardization as applied to belting.**

---

# IMPERIAL BELTING COMPANY

(INCORPORATED)

FACTORY AND GENERAL OFFICES, LINCOLN AND KINZIE STREETS  
CHICAGO, ILL.

BRANCH OFFICES:

120 Liberty Street  
NEW YORK, N. Y.

112 Market Street  
PITTSBURGH, PA.

512 Hippodrome Building,  
CLEVELAND, OHIO

924 Kearns Building  
SALT LAKE CITY, UTAH

205-208 Kresge Building  
DETROIT, MICH.

---

**Manufacturer of High Grade Belts for Conveying, Elevating and Transmitting Power**

---

**Rexall Double Stitched Belting** has proven exceptionally economical for conveying and elevating abrasive material under outdoor conditions.

**Rexall Double Stitched Package Conveyor Belting** is probably the most widely used special package conveyor belt made.

**322 Rexall Double Stitched Hog Beater Belting** resists vigorously the "breaking down" action of beater service on account of its double stitched and inner-locked construction. Every fibre is impregnated with our special gum compound which protects it from the weakening, softening action of hot water.

**Sanital Double Stitched Belting** is a white sanitary impregnated belt for conveying and elevating foodstuffs.

**Antisulpho Double Stitched Belting** is a conveyor and elevator belt capable of efficient operation while subjected to certain acid fumes injurious to ordinary belts.

**Sahara Double Stitched Belting** is designed for conveyor and elevator service where exceptional ability to resist heat is required.

**Submarine Double Stitched Belting** has proven particularly efficient where the operating conditions are unusually moist.

**Westar Double Stitched Belting** is a wet starch conveyor and elevator belt of exceptional economy.

**Karlite Double Stitched Belting** is an efficient axle drive belt for car lighting plants.

**Ibeco Double Stitched Transmission Belting** has proven itself a drive belt of exceptional strength and pliability. Its special impregnation enables it to maintain a permanently adhesive traction surface of great smoothness and gripping power without the aid of belt dressing. Actual tests have shown it able to transmit **more horsepower** at any speed than high grade oak tanned leather belting of the same width and thickness, and it can be used economically in place of either leather or rubber belting on the majority of installations. This is a strong claim, but one which has been amply justified by actual experience.

# THE ROSSENDALE-REDDAWAY BELTING AND HOSE COMPANY

NEWARK, N. J., U. S. A.

Manufacturers of "Camel Hair" and "Arabian" Hair Belting; "Durbar" Solid Woven Cotton Belting; "Senegal" Specialty Canvas Belting; "Seminole" and "Cherokee" Brands of Red Stitched-Canvas Belting; and Brake Brand Linings

## "CAMEL" HAIR BELTING:



Highest co-efficient of friction of any belting.

Twice the tensile strength of the best oak-tanned leather.

100% more elastic than leather; 50% more than other fabric belts.

Transmits safely and effectively 25% to 30% more power than other belting.

Minimum stretch; uniform in surface, width and weight.

Less affected by dampness, heat, oil, acid or alkaline fumes than other belting.

Remarkably long life—records of 28 years' continuous running.

Sold under guarantee of longer, better service than any other belting running under the same conditions.

## "ARABIAN" HAIR BELTING:

Not an *imitation* of "Camel Hair," but a *substitute* for it when price must be considered.

Hair warp gives same advantages over other belting as in "Camel Hair," though not to the degree.

Superior to any leather, rubber or stitched-canvas belt, in power transmission and long life.



## "SEMINOLE" RED STITCHED - CANVAS BELTING:

Made of "Standard" weight duck, specially impregnated, and painted.

The leader in this class of belts.



## "DURBAR" SOLID WOVEN COTTON BELTING:

Made from highest grade long fibre cotton woven under tension to a solid one-piece fabric.

Uniform in surface, thickness and width.

Impregnated with a special waterproofing compound which resists dampness, oil, acid or alkaline fumes, heat or cold.

High frictional grip, constant pliability, unusual elasticity and long life.

Has no superior in cotton beltings.



## "SENEGAL" SPECIALTY CANVAS BELTING:

The highest grade of impregnated stitched-canvas belt.

Made of full weight 32-ounce duck, with flush stitching and special gum impregnation which retains pliability, preserves belt fibres, gives high frictional grip and is little affected by dampness, heat or cold.

Superior to other stitched-canvas or rubber belting under severe service conditions.



## "CHEROKEE" RED STITCHED - CANVAS BELTING:

Made of 26-ounce duck, impregnated.

The paint used gives high frictional grip.



## EDW. R. LADEW CO., INC.

GLEN COVE, N. Y., U. S. A.

BOSTON, MASS.  
CHARLOTTE, N. C.

CHICAGO, ILL.  
CLEVELAND, O.

NEWARK, N. J.  
NEW YORK, N. Y.

PHILADELPHIA, PA.  
PITTSBURGH, PA.

Distributors in All Principal Cities of the World Carry Complete Stocks

**Manufacturers of Leather Belting, Lace Leather, Cut Lacing, Belt Cement, Belt Preservative, Belting Accessories; Hydraulic Leather, Leather Packing, Washers, Disks, Shafting Rings; Automobile, Truck and Motorcycle Belts and Specialties in Leather; Leather Welting; Straps of Every Description**

### HISTORY AND METHODS:

The House of Ladew, founded in 1835, is the oldest leather belting manufacturer and operates the largest leather belting factory in America. In every foot of Ladew Leather Belting is incorporated the skill, experience, and service-rendering capacity which have made the name "Ladew" synonymous with "belt service," the world over. Ladew Belting has never been made to meet a price. Its market is, and always has been, among those discriminating belt buyers who consider a price in correct relation to the value offered. Ladew Belting is the choice of those whose judgment and experience convince them that "better belting costs less" in the long run.

### SPECIAL BELTS FOR SPECIAL PURPOSES:

The Ladew line—in addition to the two main brands described on the next page—includes a number of other brands made from sections of the hide not considered suitable for "Flintstone" and "Turtle." These are high-grade belts—though never sold as "first-grade" belts—capable of splendid service where

the conditions are clearly understood so that the right belt can be supplied for each particular purpose. In many cases a material saving results by the use of these special belts under the advice of Ladew engineers. The House of Ladew also has unequaled facilities for producing, on short order, belts for special or unusual conditions.

### LADEW ENGINEERING SERVICE:

The proper application of belting is an engineering problem deserving of skilled counsel and the best experience. More belts are destroyed by abuse than by use—abuse here implying neglect of proper care as well as ill-advised applications. To correct wrong conditions where known, as well as to guard against them in advance where possible, Ladew Engineering Service is maintained. This consists in the advice and assistance of experienced belting engineers who will study any belting problem and give expert advice on its solution. Ladew Service is offered free to all belt users seeking the highest belting economy—which means the lowest belting cost per horse-power per year of service.

# EDW. R. LADEW CO., INC.



## "FLINTSTONE" LEATHER BELTING:

### Standard:

Introduced in 1835 and steadily improved ever since, "Flintstone" is pre-eminently the belt for all drives where everything depends upon, and everything is expected from, the power transmission. The care in selection of leather and in methods of manufacture, forbids "Flintstone" selling as a cheap belt. But, hundreds of times over, in the decades past, "Flintstone" has proved itself to be the most economical belt—the belt which gives the greatest number of years of service, at the lowest cost per year. Or, stated otherwise, "Flintstone" will transmit more power over a longer period at the lowest cost per horse-power per year. The Ladew trade-mark on "Flintstone" is a guarantee of maximum belting service at minimum belting cost.

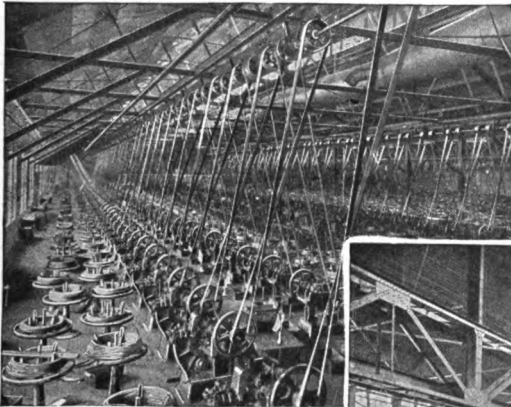


## "TURTLE" LEATHER BELTING:

### Waterproof:

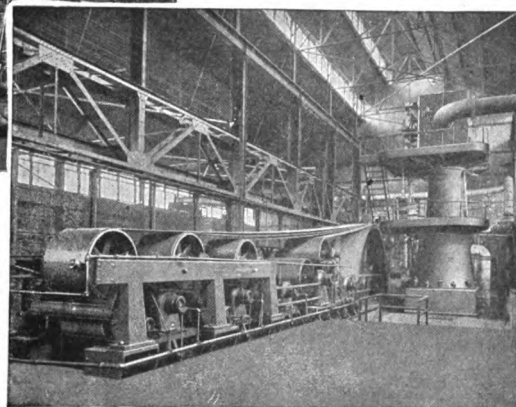
Introduced in 1860, "Turtle" is the original waterproof belt. It is made from center cuts of the best selected hides, tanned and curried by most approved methods, thoroughly impregnated with a water-resistant, water-repellant material, and built up with a special waterproof cement. Even under most extreme moisture conditions, the laps or plies will not open up. For all drives where the utmost in service is sought, in the presence of water, steam, oil or acid fumes, "Turtle" has a record that proves its unsurpassed qualities. The Ladew trademark on each "Turtle" belt is a guarantee of Ladew quality—which has been a belting standard for over 80 years.

325



This big wire nail mill is driven throughout with "Flintstone" Belts. The owners know from experience that "Flintstone" is protection against shut-downs due to belting troubles

These four big "Flintstones" have, at this writing, given more than five and one-half years of continuous service. The best previous record on this drive by other belts was 18 months of service



## NEW YORK RUBBER COMPANY

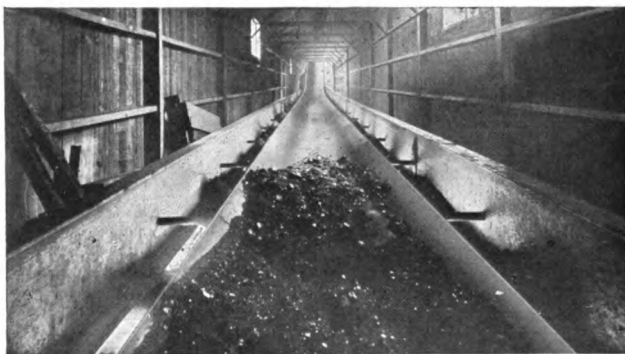
Incorporated 1851

NEW YORK  
34 READE ST.

HOUSTON, TEXAS  
805 FRANKLIN AVE.

CHICAGO  
325 W. RANDOLPH ST.

Manufacturers of Mechanical Rubber Goods



"Dependable" No. 4 Conveying Anthracite Coal

### 326 "DEPENDABLE" CONVEYOR BELTING:

Made with three grades of cover— for service in connection with materials of greater or lesser abrasive qualities. Constructed to eliminate sheering as far as is physically possible—edges protected against edgewear. "DEPENDABLE" Conveyors may be depended upon to deliver the goods.

Other Brands—"GOLD DREDGE," "BLUE BIRD" and "STONORE"—the latter also offered in three grades of cover.

### TRANSMISSION BELTS:

**Triumph:** Friction surface. Fancy belt for permanent installation where

initial outlay is not deciding factor. It is worth the difference.

**Wicapee:** Friction surface. Recommended for main and important counter drives. *It has stood the test of Time.* Its installation insures economical transmission.

**Our Extra:** Friction surface. A good belt for ordinary service. Excellent results obtained in the open, such as on agricultural machinery, etc.

Other Brands: "Tractor," Friction Surface; "Special Elevator;" "Dutchess Stitched;" "Stacker;" "Cameo" and "Clinton" Brands.

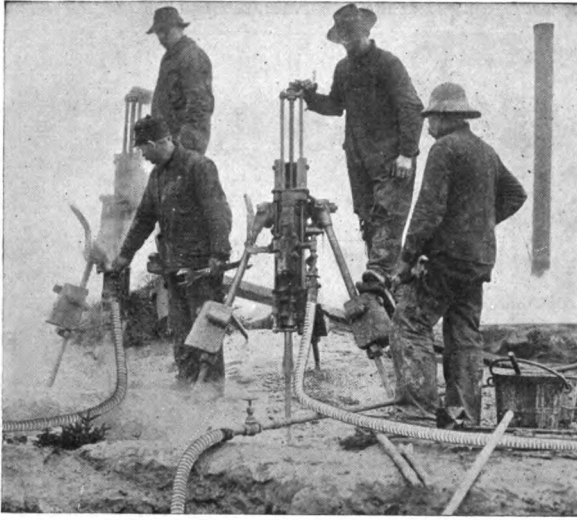
We also make hogscraper belts, axle generator belts, as well as special belts for any particular service.



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## NEW YORK RUBBER COMPANY

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### **"DUTCHESS" AIR DRILL HOSE:**

A perfect balance of selected materials and the knowledge of combining them has produced this excellent air drill hose.

### **"DUTCHESS" STEAM HOSE:**

Like "DUTCHESS" Drill Hose this is the only hose for this purpose we manufacture. In service in all industries from coast to coast the natural assumption is it is abused as well as used without complaint. We unreservedly recommend Dutchess.

### **WATER HOSE:**

Again it is "DUTCHESS" which is our first offering. Higher pressures and

service conditions more severe than **327** ordinarily encountered are the proper settings for "DUTCHESS" Water Hose.

For ordinary conditions we offer the "CAMEO" Brand.

For out-door fire protection "BLUE BIRD" Rubber Fire Hose is unsurpassed. Flexible and strong, it carries the usual fire hose guarantee as to pressure and service.

We also manufacture dependable hose for pneumatic tool work, Suction, Rotary Drilling, Spraying, Chemical Fire Apparatus, Car and Engine connection, etc., etc.

# J. E. RHOADS & SONS

MAIN OFFICE: 12 NORTH THIRD STREET, PHILADELPHIA

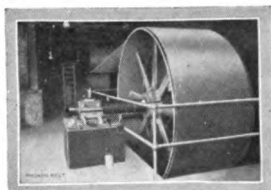
NEW YORK

CHICAGO

WILMINGTON

Manufacturers of Leather Belting, Flat and Round, Leather Belt Preserver  
Tanners of Tannate Belting Leather and Tannate Lace Leather

## RHOADS OAK BELTING:



The unusual strength and durability of Rhoads Belts save breakdowns and loss from stoppage. Their slight stretch, their trueness, even balance and grip save slippage and take-ups.

## LEATHER BELTING PRICE-LIST

328

Adopted November 21, 1906

Prices per Running Foot

3 1/4 in.	\$ .78	15 in.	3.60	34 in.	8.16
3 1/2 in.	.84	16 in.	3.84	36 in.	8.64
3 3/4 in.	.90	17 in.	4.08	38 in.	9.12
4 in.	.96	18 in.	4.32	40 in.	9.60
4 1/4 in.	1.08	19 in.	4.56	42 in.	10.08
5 in.	1.20	20 in.	4.80	44 in.	10.56
5 1/4 in.	1.32	21 in.	5.04	46 in.	11.04
6 in.	1.44	22 in.	5.28	48 in.	11.52
6 1/4 in.	1.56	23 in.	5.52	50 in.	12.00
7 in.	1.68	24 in.	5.76	52 in.	12.48
7 1/4 in.	1.92	25 in.	6.00	54 in.	12.96
9 in.	2.16	26 in.	6.24	56 in.	13.44
10 in.	2.40	27 in.	6.48	60 in.	14.40
12 in.	2.88	28 in.	6.72	64 in.	15.36
13 in.	3.12	30 in.	7.20	68 in.	16.32
14 in.	3.36	32 in.	7.68	72 in.	17.28

Double Belts List at Twice the Price of Single.

## TANNATE LEATHER BELTING:



In Tannate Flat Belting you find the above advantages, plus the remarkable toughness given by our Tannate tannage. Tannate takes strong grip on the pulley, reducing slippage to the lowest terms. It has remarkable power of resisting heat.

## TANNATE FLAT PRICE-LIST

Revised October 25, 1918

Net per Running Foot

### SINGLE BELT

1/2 in.	\$.13	2 1/4 in.	.59	5 in.	1.30
3/8 in.	.16	2 1/2 in.	.65	5 1/2 in.	1.43
1/4 in.	.20	2 3/4 in.	.72	6 in.	1.56
5/8 in.	.23	3 in.	.78	6 1/2 in.	1.69
1 in.	.26	3 1/4 in.	.85	7 in.	1.82
1 1/4 in.	.33	3 1/2 in.	.91	8 in.	2.08
1 1/2 in.	.39	3 3/4 in.	.98	9 in.	2.34
1 3/4 in.	.46	4 in.	1.04	10 in.	2.60
2 in.	.52	4 1/2 in.	1.17	12 in.	3.12

### DOUBLE BELT

1/2 in.	\$.26	5 in.	2.60	32 in.	16.64
3/8 in.	.33	6 in.	3.12	34 in.	17.68
1/4 in.	.39	7 in.	3.64	36 in.	18.72
5/8 in.	.46	8 in.	4.16	38 in.	19.76
1 in.	.52	10 in.	5.20	40 in.	20.80
1 1/4 in.	.65	12 in.	6.24	42 in.	21.84
1 1/2 in.	.78	14 in.	7.28	44 in.	22.88
1 3/4 in.	.91	15 in.	7.80	46 in.	23.92
2 in.	1.04	16 in.	8.32	48 in.	24.96
2 1/4 in.	1.17	17 in.	8.84	50 in.	26.00
2 1/2 in.	1.30	18 in.	9.36	54 in.	28.08
2 3/4 in.	1.43	20 in.	10.40	56 in.	29.12
3 in.	1.56	24 in.	12.48	60 in.	31.20
3 1/2 in.	1.82	26 in.	13.52	72 in.	37.44
4 in.	2.08	28 in.	14.56		
4 1/2 in.	2.34	30 in.	15.60		

## TANNATE ROUND BELTING:

For twenty odd years Tannate Round Belting has been outlasting ordinary belts from two to five times. Its remarkable grip permits easy drives, and its extreme strength gives unusual durability. It saves you take-ups and repairs. For clothing and shoe factories, it has all competitors beaten. It costs less in the long run.

## NET PRICES

Revised August 7, 1918

In not less than:	1000 Ft. lots, per 1000 ft.	500 Ft. lots, per 100 ft.	100 Ft. lots, per 100 ft.	Per foot
1/8	\$34.50	3.70	3.95	5 1/2 c
3/8	41.00	4.45	4.75	5 3/4 c
3/16	46.50	4.75	4.90	6 1/4 c
3/8	48.90	5.00	5.40	6 1/2 c
Reg.				
1/4	49.60	5.25	5.50	6 3/4 c
Full				
1/4	63.00	6.65	6.95	9c
3/8	82.80	8.40	8.95	10c
1/2	109.00	11.30	12.00	13 1/2 c
3/4	148.30	15.70	16.50	18c
1	173.20	18.10	19.00	21 1/2 c
1 1/8	207.70	21.40	22.20	26 1/4 c
1 1/4	242.40	25.10	26.00	32c
1 1/2	297.00	30.50	31.35	37c

The above prices are made only when the quantities specified are ordered for shipment at one time. The quantities may be made up of different sizes.

# J. E. RHOADS & SONS

## TANNATE LACE LEATHER:



Tannate Lace Leather lasts from three to five times as long as ordinary rawhide. It keeps tough and flexible, and it does not break until it wears out. It saves labor of lacing and the labor costs more than the lace. It increases output and costs less per year.

### PRICES ON TANNATE CUT LACE Revised May 21, 1919

	1000 Ft. Lots, per 100 ft.	500 Ft. Lots, per 100 ft.	100 Ft. Lots, per 100 ft.	Less than 100 Ft., per ft.
$\frac{1}{4}$ in.	\$2.65	2.70	2.85	4 $\frac{3}{4}$ c
$\frac{1}{8}$ in.	3.15	3.30	3.45	5c
$\frac{3}{8}$ in.	3.70	3.80	3.95	5 $\frac{1}{2}$ c
$\frac{1}{2}$ in.	4.20	4.50	4.65	6 $\frac{1}{4}$ c
$\frac{5}{8}$ in.	4.85	4.95	5.25	6 $\frac{1}{2}$ c
$\frac{3}{4}$ in.	5.95	6.30	6.60	8c
$\frac{7}{8}$ in.	7.20	7.50	7.90	8 $\frac{1}{2}$ c

## TANNATE LACE IN BACKS

Less than  $\frac{1}{2}$  dozen, at 92c per sq. ft.  
 $\frac{1}{2}$  dozen and over, at 86c per sq. ft.

The above prices are made only when the quantities specified are ordered for shipment at one time. The quantities may be made up of different sizes. These prices are net.

## RHOADS LEATHER BELT PRE-SERVER:

There is an ancient belt that has driven a Pennsylvania flour mill since 1882. This belt owes its green old age to having been treated with Rhoads Preserver for more than 20 years. Rhoads Preserver is highly beneficial to leather. It keeps belts pliable and strong, and gives them the hug and grip that promote maximum output. It reduces your belt bills.



### NET PRICES

Revised April 3rd, 1919

#### LIQUID

1 Gal. ( 7 $\frac{1}{2}$ lbs.)	\$.28 lb.
5 Gals. (37 $\frac{1}{2}$ lbs.)	.25 lb.
10 Gals. (75 lbs.)	.23 lb.
Bbls. or $\frac{1}{2}$ bbls.	.21 lb.

#### PASTE

10 lb. cans	.32 lb.
25 lb. cans	.30 lb.
50 lb. cans	.27 lb.
Bbls. or $\frac{1}{2}$ bbls.	.24 lb.

329

Barrels contain about 400 lbs.

Prices based strictly on quantity taken in one order and according to size of cans, no matter what the total amount, viz., if 25 10-lb. cans are ordered, 10-lb. price is charged.

## RHOADS STICK BELT DRESSING:



For belts that slip because of excessive load or other unusual conditions, use Rhoads Stick Belt Dressing. It promotes flexibility and gives a grip that keeps down slippage.

### NET PRICES

Revised April 3rd, 1919

One 1-lb. stick	.45 each
1 doz. 1-lb. sticks	.40 each
50 1-lb. sticks	.38 each
One 3-lb. stick	1.15 each
Sample stick	.15 each

## CHAS. A. SCHIEREN COMPANY

MAIN OFFICE: 30-38 FERRY ST., NEW YORK CITY

OAK LEATHER TANNERIES:  
BRISTOL, TENN.

BELTING FACTORY:  
NEW YORK

**Tanners and Manufacturers of Leather Belting of All Kinds, Belt Cement, Belt Dressing, Rawhide Rope.**  
**Lace Leather, Cut Lacing, Hydraulic Leather**

Branches and Stocks located in Atlanta, Boston, Chicago, Cleveland, Denver, Detroit, Kansas City, Memphis, Milwaukee, Philadelphia, Pittsburgh, Salt Lake City, Seattle, St. Louis, Dallas. Agents in all large cities, and in foreign countries.

Our line of products includes the following:

**"DUXBAK" Leather Belting**, an oak bark-tanned leather belting which is made proof against water, steam, machinery oils and acid fumes.



This is the largest selling brand of belting in the world. It is suitable for use anywhere under the most severe service conditions.

**330 "BULL'S HEAD" Leather Belting**, oak bark-tanned, heavy weight in all sizes. For large drives where there is no moisture.



**"ROYAL EXTRA" Leather Belting**, oak bark-tanned, regular weight but not waterproof. A-1 grade in every particular.



**"EAGLE BRAND":**  
a light-double belting especially suitable for motor and other high speed work.



**PERFORATED Leather Belting**

**LINK Leather Belting**

**ROUND Leather Belting**

**Cut Lacing**

**Belt Dressing**

**Lace Leather**

**Packing, Hydraulic**

**Hydraulic Leather**

**Rawhide Rope**

**Belt Cement**

**Leather Specialties**

*Chas. A. Schieren Company*

### FACILITIES:

Our tannery is located at Bristol, Tennessee, in the heart of a great oak bark section. Its capacity is sufficient to keep the factory at New York supplied at all times with oak bark-tanned leather for all grades of Schieren Beltings.

Branches and stocks located in many of the principal cities assure prompt shipment and quick delivery of orders to belt users in any section of the country.

### SERVICE:

We will be pleased to figure on your requirements in our line. Literature will be furnished and prices quoted upon request.

In order that you may have full benefit of our fifty years' experience in the business, and that we may feel justified in placing our full guarantee upon the belts, we request that in every instance possible you give us full details of the design of the drive and particulars of the service expected. Specially printed blanks for this purpose will be furnished free upon request.



When writing us don't forget to request a copy of booklet entitled "The Story of Schieren Beltings."

# SHULTZ BELTING COMPANY

ST. LOUIS, MO., U. S. A.

BRANCH: 111 Chambers Street, New York

Manufacturers of Shultz Sable Rawhide Belting, Aqua Waterproof and Steamproof Belting, Oak Tanned Belting, Belt Dressing, Lace Leather, Etc.

## SHULTZ SABLE RAWHIDE BELTING:

Shultz Belting is made from the heaviest Packer Steer Hides and the reason why this belting excels all others is because the leather is tanned by our own special process and prepared from the raw material to the finished product under our own personal supervision.

SABLE Rawhide Belting is tanned on the surface—for contact, and the interior is rawhide—for strength. This, combined with its great strength and



This Is Easily Done with Sable Belting of Double Thickness

pliability, enables SABLE to hug the pulleys closer, transmit 25% more power, increase your production and outwear any oak tanned belt.

## SHULTZ AQUA BELTING (Chrome Tan):

"AQUA" is an absolute Waterproof and Steamproof Leather Belt. It is intended for laundries, dyehouses, bleacheries, damp climates or any place where wet conditions exist.

Now here is where "Aqua" is different from other types of so-called waterproof belts. The waterproofing is tanned right in. It's waterproof on the surfaces and



Reg. U. S. Pat. Off.

it's waterproof in the middle and remains waterproof under the worst conditions. You can boil a double in live steam and the plies will not separate or the leather lose its strength or pliability.

331

"Aqua" will outlast any rubber or canvas belt ever made and transmit from 25% to 33% more power.

## Test Out:

A SABLE Rawhide or "AQUA" Waterproof Belt on a 60-day "try-it-before-you-buy-it" basis. That is a mighty fair proposition and it gives you an opportunity of letting your eyes be the judge and your money the last thing you part with.



TRADE MARK

Write for catalogue No. 11.

## **FLEXIBLE STEEL LACING CO.**

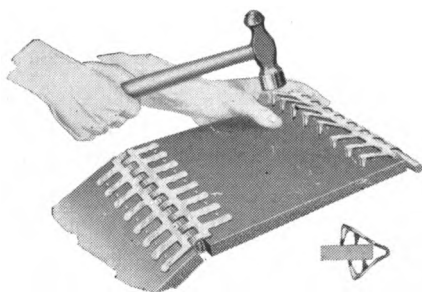
DEPT. 600, 522 S. CLINTON STREET, CHICAGO, ILL.

**Manufacturers of Steel Belt Lacing, Incandescent Lamp Guards**

*These Products Are Specialists—They Do One Thing Well.*

### **ALLIGATOR FLEXIBLE STEEL BELT LACING:**

Repairs belts quicker, makes stronger joints, saves more time, money and labor than does any other belt lacing.



332

The connecting bar between prongs is indented on the under side to allow it to be broken into required lengths and the use of a single section on any width of belt up to 12 inch. Each indentation separates a full staple which retains its efficiency.

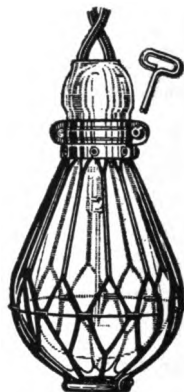
Alligator lacing is easily applied by any workman with a hammer. It will not injure the belt and makes a smooth, flexible joint that works perfectly under all conditions and is quickly disconnected if required. Alligator lacing is made for all kinds and sizes of flat belting.

Equip with Alligator now. Gives lasting service on leather, cotton, rubber, balata or any width or thickness of machinery belting.

### **FLEXCO LOK LAMP GUARD:**

It guards lamps against breakage and theft; saves time, money and eliminates danger.

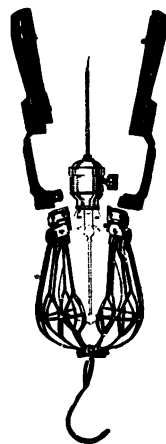
It is made of strong expanded steel—the halves hinge at the bottom, cover the globe and clamp over the socket, fastening with self-retaining key-locking screws.



The Flexco Guard is similar but is closed with a round head slotted screw.

### **FLEXCO SPLIT HANDLE PORTABLE**

is a convenient handle that combines with Flexco guards. It clamps over the socket without rewiring and makes a utility portable guard that can be carried or hung where desired.



*Complete information and prices covering these aids to efficiency will be sent on request.*

**CATALOGUE SECTION  
PART IV**

**Elevating and Conveying Machinery  
Hoisting and Transporting  
Machinery**

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**Pages 335-388**





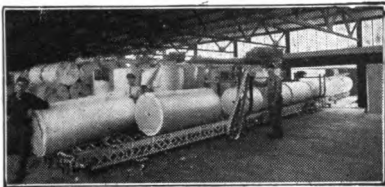
## BROWN PORTABLE CONVEYING MACHINERY CO.

MAIN OFFICE: CHICAGO, ILL., U. S. A.

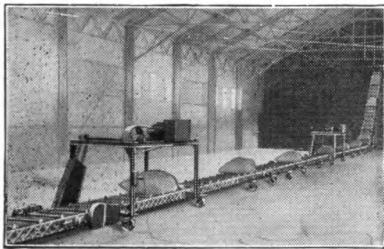
Sales Representatives in the Principal Cities and in all Important Foreign Countries

**"BROWN" PORTABLE CONTINUOUS  
MOTION LOADERS—UNLOADERS  
— CONVEYORS — ELEVATORS —  
STACKERS, for either loose or packed  
materials. Also PORTABLE VER-  
TICAL LIFT PLATFORM ELE-  
VATORS:**

The "Brown" line of Portable Conveying Machines are always "Built to Fit the Job," with engineering exactitude, and therefore provide for every possible or peculiar handling condition in the design, resulting in the highest possible savings in labor, money and time.



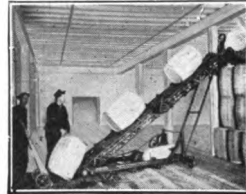
Conveyor Loading into Boat



Conveying and Stacking as One Operation

Portable continuous Motion Conveyors; inclined, adjustable delivery Elevators (Stackers); Loaders; Unloaders—both belt type for loose (bulk) materials (not illustrated) and chain belt-axle carriage type for packed materials—handles boxes, barrels, rolls, bags, bundles,

etc. Either machine may be operated singly, or in series, to perform several handling operations as one. Reversible in motion—convey in either direction. Contains own power—Electric, Kerosene or Gasoline. Only few types illustrated.



Portable Elevator Stacking Barrels

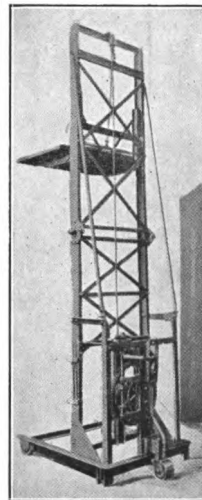


One Design of Boat Unloader

335

Also the "Brown" Portable "Vertical Lift" platform Elevator for packed materials.

"Brown - Portables" are installed all over the world, adopted by the largest governments, down to the small businesses because they save and pay. **Every machine is guaranteed.**



Large Size "Vertical Lift"

*Send details of handling problem and ask for Bulletin 40A. No obligation.*

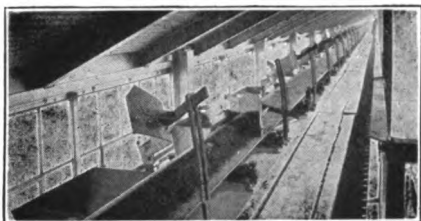
## THE C. O. BARTLETT & SNOW CO.

CLEVELAND, OHIO, U. S. A.

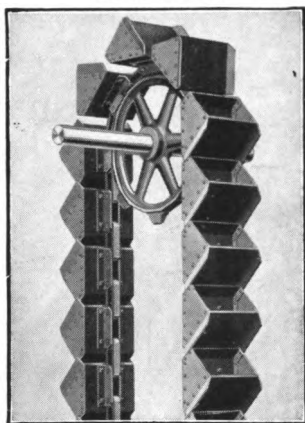
**Designers and Builders of Dependable Equipment for the Handling and Preparation of Materials. Conveying and Elevating Machinery; Skip Hoists; Dryers; Crushers; Screens; Mixers**

### BARTLETT AND SNOW ELEVATING AND CONVEYING MACHINERY:

Is well fitted for all conditions which demand economy and dependability.

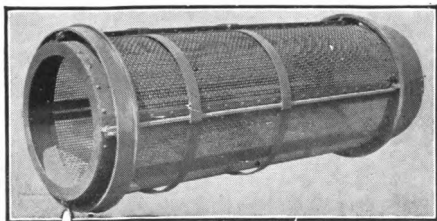


**Belt Conveyor Handling Tempered Sand in Foundry**



**Continuous Bucket Elevator**

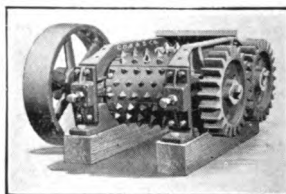
Included in Bartlett and Snow Elevating and Conveying Machinery are: Bucket elevators and conveyors, flight conveyors, apron conveyors, belt conveyors, and screw conveyors.



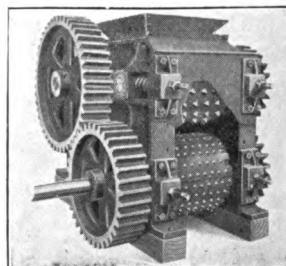
**Rotary Screens for All Conditions**

### BARTLETT AND SNOW COAL CRUSHERS:

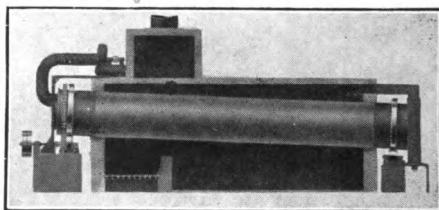
Include single roll crushers, two roll crushers, and four roll crushers.



**Two Roll Coal Crusher**



**Four Roll Coal Crusher**



**Style "D" Dryer—One of Thirteen Different Types**

### BARTLETT AND SNOW DRYERS:

Comprise thirteen distinctly different types, each one of which has been developed for the proper and economical drying of a certain class of materials. Among these thirteen types there are direct fired direct heat dryers, direct fired indirect heat dryers, direct fired single pass dryers, direct fired double pass dryers, steam heated dryers, and hot air dryers.

## H. W. CALDWELL & SON COMPANY

17TH ST. AND WESTERN AVE., CHICAGO, ILL.

EASTERN OFFICE: 50 Church St., NEW YORK CITY  
709 Main St., DALLAS, TEXAS

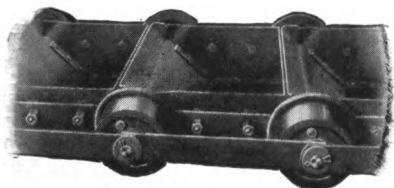
**Manufacturers of Elevating, Conveying and Power Transmitting Machinery;  
Machinery for Handling Material in Bulk or Packages**

### "HELICOID" CONVEYORS:



Sole manufacturers of "HELICOID" SCREW CONVEYOR made of one continuous strip of metal without laps or rivets. Mounted on standard and extra heavy pipe or solid shafts.

### PAN, APRON AND BELT CONVEYORS:



Each designed and built to handle the material for which it is best suited, to the best advantage. For COAL, COKE, SAND, CRUSHED STONE, GRAVEL, GRAIN, BOXES, BARRELS, etc.

### CHAINS:

Standard Malleable Iron Detachable Chain. Malleable and steel bushed chains with or without rollers. Special chains for Conveying, Elevating or Power Transmitting Purposes.



### CHILLED RIM SPROCKETS:

The life of the Chilled Rim sprocket is from Three to Five times that of the ordinary grey iron sprocket. Traction wheels and special sprockets furnished.

### BUCKETS:

We carry a large stock of standard size and weight Salem, Seamless Steel and Malleable Buckets. We are equipped to make special Buckets of all kinds to order.



### GEARS:

We can furnish gears with cast Teeth Machine Molded or Machine Cut. We have the most complete equipment in the country for machine molding gears. Spurs, Bevels, Miters, Worms, Worm Wheels and Mortise Wheels. 337



We are prepared to furnish sheet steel conveyor troughs, hoppers, elevator casings, spouting, etc.

For a complete list of our line see a copy of our No. 38A catalogue. 800 pages of useful information to every engineer, designer, plant owner or superintendent.



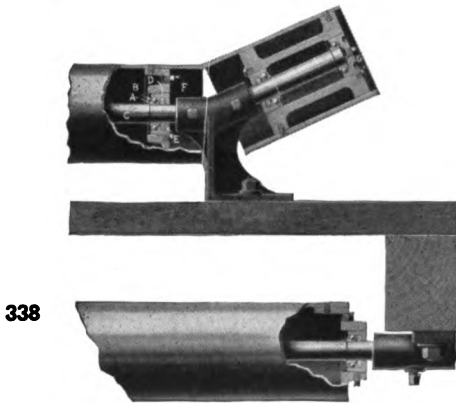
## THE CONVEYING WEIGHER CO.

90 WEST STREET, NEW YORK, N. Y.

**Ball Bearing Belt Conveyors; Continuous, Automatic Scales for Belt and Other Conveyors; Conveying and Hoisting Machinery; Complete Material Handling Plants; Trump Measuring and Mixing Machines; Trump Concrete Mixers**

AGENCIES: HERBERT AINSWORTH, Esq., The Corner House, JOHANNESBURG, S. AFRICA  
THE A. M. ELLICOTT Co., 301 St. James Street, MONTREAL, CANADA  
MR. FRANK R. PERRON, Aberdeen House, 204 Clarence St., SYDNEY, N. S. W.  
MR. LUCIEN HERMANN, London Wall Bldg., LONDON, ENG.  
VICTOR M. BRASCHI MACHINERY COMPANY, MEXICO CITY, MEX  
ZIMMER CONVEYOR COMPANY, 82 Mark Lane, LONDON, E. C., ENG.  
J. E. ROBERTSON, Mills Bldg., EL PASO, TEX.

### BALL BEARING BELT CONVEYORS:



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"Conweigh" Ball Bearing, Troughing and Return Idlers for Belt Conveyors (Patents Pending)

We illustrate herewith the construction of ball bearing troughing and return idlers for belt conveyors. It is guaranteed that if a belt conveyor running level be equipped with these idlers, there will be a saving of 40% in power required. These idlers having felt oil-retaining washers need to be lubricated only once in two years.

A—Hardened steel "Cone" fitted on turned steel shaft

B—Pressed steel "Ball Retainer"

C—Turned steel shaft, set screwed in Idler brackets

D—Oiled washer of felt or carded wool

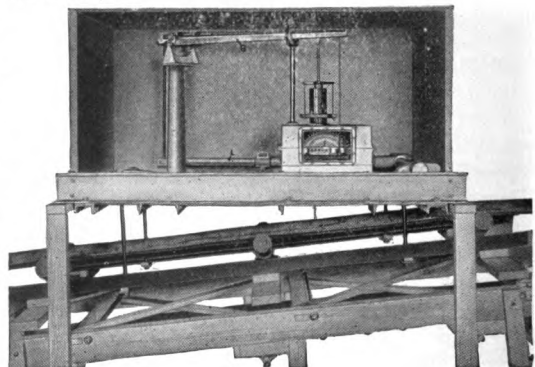
E—Hardened steel "Plug" screwed into pulley hub

F—Brass plug for lubrication

G—Lock screw to prevent hardened plug from turning

### THE MERRICK CONVEYING WEIGHER:

This device records the weight of material handled on belt conveyors, bucket conveyors, cable railways and overhead trolleys or telfers. The weigher consists of a pair of weighing levers and a steelyard of special design so that a short section of the conveyor can be suspended from the weighing levers. The extreme end of the steelyard is connected with a totalizing mechanical integrator which derives its other factor from the travel of the conveyor by means of suitable gearing from a bend pulley on the return belt, or a sprocket wheel if on a bucket conveyor. This integrator continuously totalizes the product of two quantities, one proportional to the weight of material suspended and the other to the travel of this material. The result therefore represents the total weight of material and is plainly indicated by a register.



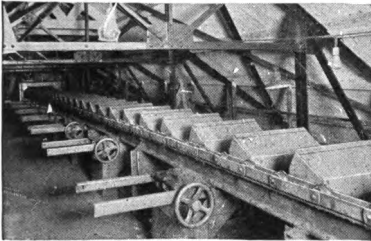
View of Conveyor Weigher. Front Sheet of Casing Removed

## DEPERE MANUFACTURING CO.

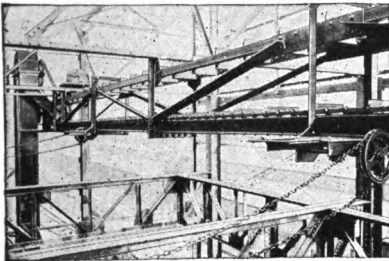
CHICAGO, ILL.

WEST DEPERE, WIS.

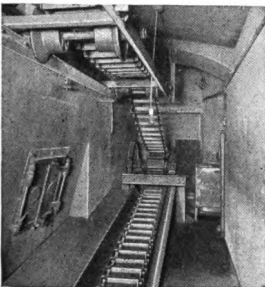
**Manufacturer of Coal and Ash Handling Systems for Power Plants**



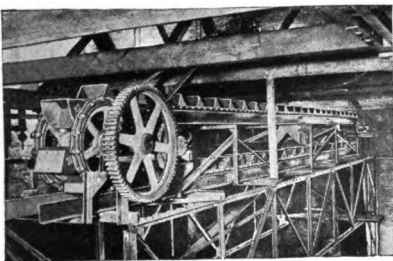
**V-Bucket Coal Distributing Conveyor**



**Coal Elevator and Flight Conveyor**



**Drag Chain Ash Conveyor**



**V-Bucket Elevator Conveyor**

### DEPERE SERVICE:

We specialize on coal and ash handling equipment for the power plant.

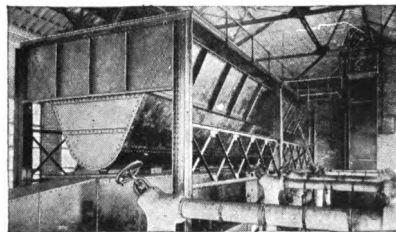
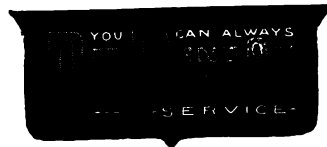
We aim to render a Service which shall assure in every case supplying just what will best serve the requirements of the situation, in the simplest dependable form and at the lowest economical cost.

Every installation is the result of individual study, to suit exactly the conditions existing.

We have no one line of machinery to urge, but use in every situation the type and arrangement of equipment which experience has proved best adapted to the work in hand—always with due consideration of proper balance between initial costs and ultimate economy, in fulfilment of that important duty of the capable engineer—to give the utmost of real value for every dollar of expenditure.

339

Let us submit our plans and proposals when you have a new plant to equip or an old one to improve.



**Distribution by Screw Conveyor**

## GIFFORD-WOOD CO.

MAIN OFFICE AND WORKS: HUDSON, N. Y.

BRANCH OFFICES:

NEW YORK  
30 Church St.

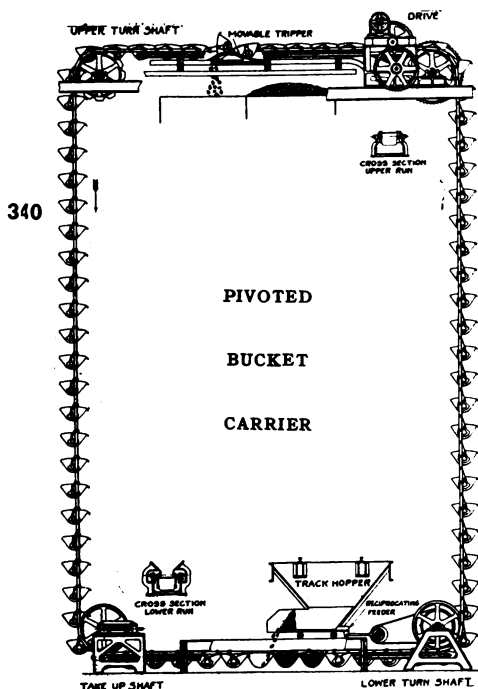
BUFFALO  
Electric Bldg.

BOSTON  
51 N. Market St.

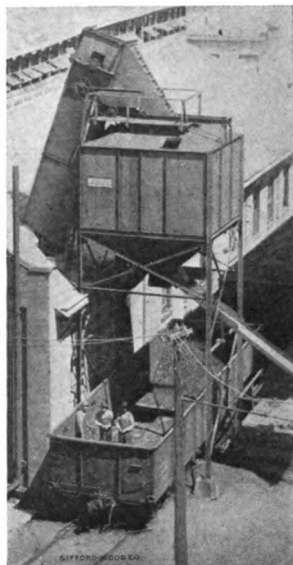
CHICAGO  
565 W. Washington St.

PHILADELPHIA  
Widener Bldg.

**Manufacturers of Elevating & Conveying Machinery** for handling coal, ashes, stone, sand, gravel, ice (natural and manufactured), and bulky materials of all kinds: Coal Handling Machinery; Wagon Loaders; Locomotive Coaling Stations; Ice Elevators, Conveyors, and Ice Tools; Apron Conveyors.



Also G-W Pivoted Bucket Carriers, Grain Elevator Machinery, Warehouse Conveyors, Car Unloaders, Coal Pockets, Bagging Machines for coal and coke, Screens of all kinds, Friction Clutches, Gray Iron Castings, Hoists, Icing Station Equipment, Crushed Ice Carts, etc.



**Coal and Ashes Handling Machinery**

You are constantly looking for ideas and suggestions that will provide means to reduce the cost of handling your coal and ashes. The illustration shows a G-W installation and a suggestion for you—why not adopt it?

Any of the following publications in which you may be interested mailed upon request:

General Catalog No. 18.

Elevating and Conveying Machinery No. 31.

Coal Machinery Catalog No. 19.

Pivoted Bucket Carrier Bulletin No. 17.

Ice (Natural) Machinery Catalog 1919.

Artificial Ice Handling Equipment Catalog No. 34.

Power Field Saws No. 42.

Creasey Ice Breaker Pamphlet.



## LINK-BELT COMPANY

PHILADELPHIA

CHICAGO

INDIANAPOLIS

**Manufacturers of Elevating and Conveying Machinery for Every Purpose.**

**Power House Equipment. Power Transmission Machinery**

Original Ewart Link-Belt, >FLINT-RIM< Sprocket Wheels, Link-Belt Silent Chain Drives, Power Transmission Machinery, Pillow Blocks, Friction Clutches.

Power House Equipment: Peck Overlapping Pivoted Bucket Carriers, Belt Conveyors, Coal Bunkers, Crushers, Chutes, Telescoping Ashes Elevators, Coal Storage Systems, Traveling Water Intake Screens.

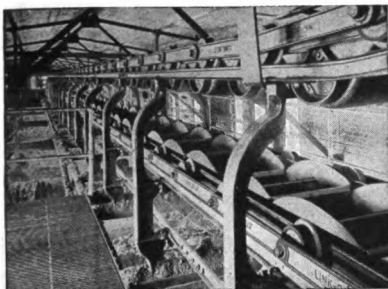
Bridge Tramways, Locomotive and Gantry Cranes, Telfers, Electric Hoists, etc.

Coal Tipples, Coal Washeries, Centrifugal Coal Driers, Car Hauls, Crushers, Screens, Picking Tables, Chutes, Wholesale and Retail Coal Yard Equipment, etc.

Locomotive Coaling Stations, Cinder Stations, Complete Freight Handling Equipments.

Package Handling Machinery, Store Service Conveyors.

Portable Wagon and Truck Loaders, Portable Bag and Box Piling Machines.

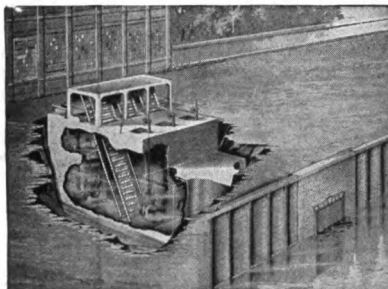


Peck Overlapping Pivoted Bucket Carrier, for Coal and Ashes

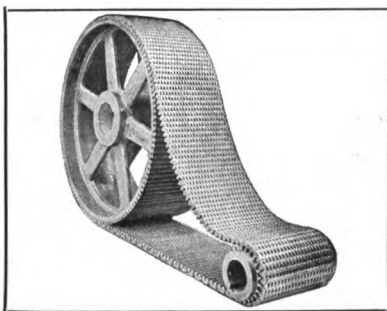


Belt Conveyor

341



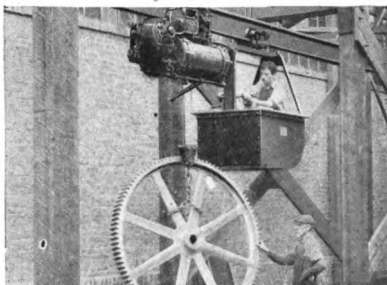
Link-Belt Traveling Water Intake Screens



Link-Belt Silent Chain



Link-Belt Locomotive Crane Storing Coal



Link-Belt Electric Hoist



## **C. W. HUNT COMPANY, INC.**

**WEST NEW BRIGHTON, STATEN ISLAND, NEW YORK**

New York City Office: 140 Nassau St.

**Manufacturers of Coal and Ash Handling Machinery, Pivoted Bucket Conveyors, Hoisting and Conveying Machinery, Cable and Automatic Railways, Skip Hoists, Industrial Railway Equipments, Electric Locomotives, Motor Cars, Storage Battery Industrial Trucks, Transmission and Hoisting Rope, Special Scales and Weighing Hoppers, Coal Crackers**

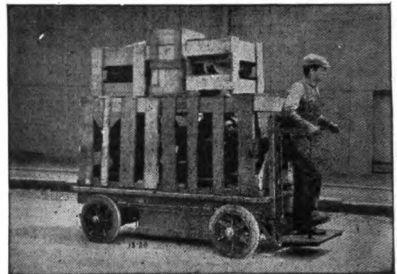
### **INDUSTRIAL RAILWAYS AND CARS:**

The boiler room cars for bringing coal to boilers are so designed that the labor of firing is reduced to a minimum, and the boiler room is kept clean. We design all types of cars for use in foundries, machine shops and all kinds of manufacturing plants. The use of outside flanged wheels permits one man to push a one-ton load on a sharp curve.



**Single Door Charging Car**

*Ask for Catalog U 18-9 on "Industrial Railways."*



**Storage Battery Industrial Truck**

*Catalog U 18-8 on request.*

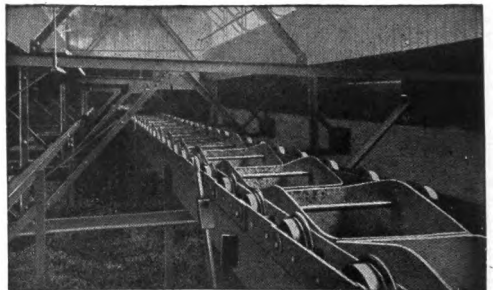
**342**

### **STORAGE BATTERY INDUSTRIAL TRUCK:**

The Storage Battery Industrial Truck is designed to take the place of hand trucks, has a capacity from 2000 to 4000 lbs.; is simple and reliable.

### **PIVOTED BUCKET CONVEYORS:**

Consist of a series of independent swinging buckets free to dump in either direction. Conveyors can run in any direction, the buckets hanging in an upright position, therefore dry or liquid material can be handled. The peculiar system of driving by a pawl relieves the conveyor wheels of all stress.



**Hunt Conveyor over Coal Bunker**

*Ask for Catalog U 15-4 on "Conveyors."*



## C. W. HUNT COMPANY, INC.

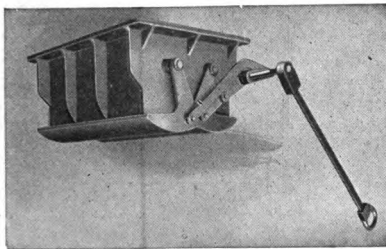
### MEASURING CHUTES:



Air Operated Measuring Chute

Offer a method of accurately recording the volume of materials delivered. These chutes are used on locomotive coaling stations and their use results in accurate record of coal delivered to locomotive. Measuring chutes are operated by air or manually. *Catalog U 15-3.*

### HUNT GATES:



24" X 36" Duplex Gate

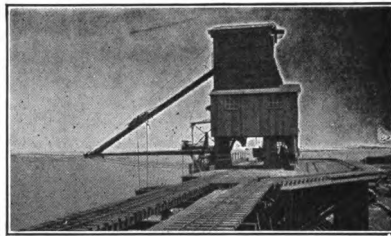
For coal and ashes pockets, also for any service where the flow of materials is to be controlled. These gates are designed for easy operation—they are manufactured in various types and sizes. *Catalog U 15-3* gives full data on this subject.

### INCLINED BOOM HOISTING ELEVATORS:

Are for rapid and economical hoisting of materials from vessels. The bucket, whether large or small, is carried from the hold of the vessel to the dumping place every trip in exactly the same

course, and at any rapidity demanded. The bucket is carried exactly where wanted, rising vertically from the hold to the boom, running up the boom, and dumping at a fixed place.

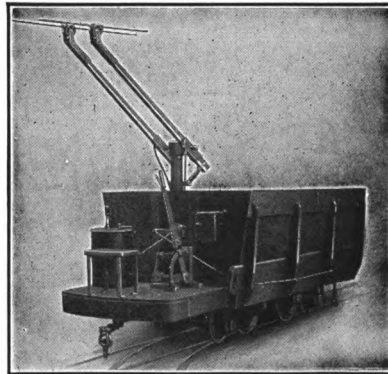
These elevators are proportioned to suit the work and for use either with tubs or grab buckets. The lighter size is especially adapted for coal or ore hoisting, using any size bucket up to one-ton capacity.



Inclined Boom Hoisting Elevators

### HUNT MOTOR CARS:

Self-Dumping



Hunt Motor Cars  
Self-Dumping

Made in many types, capacities up to 10 tons, and are equipped with motors and overhead trolleys or shoes for third rail as desired. Suitable for transporting coal, fertilizer materials, ores, and other bulk materials.

*General Catalog U-102 on request.*

## THE JEFFREY MFG. CO.

904 NORTH FOURTH ST., COLUMBUS, OHIO

### BRANCHES

NEW YORK  
BOSTON  
PHILADELPHIA

PITTSBURGH  
CLEVELAND  
MILWAUKEE

CHICAGO  
ST. LOUIS  
DENVER

SEATTLE  
BIRMINGHAM  
DALLAS

MONTREAL

### Manufacturers of:

**CONVEYERS**—Apron, Scraper, Belt, Pan, Pivoted Bucket, Spiral and other types.

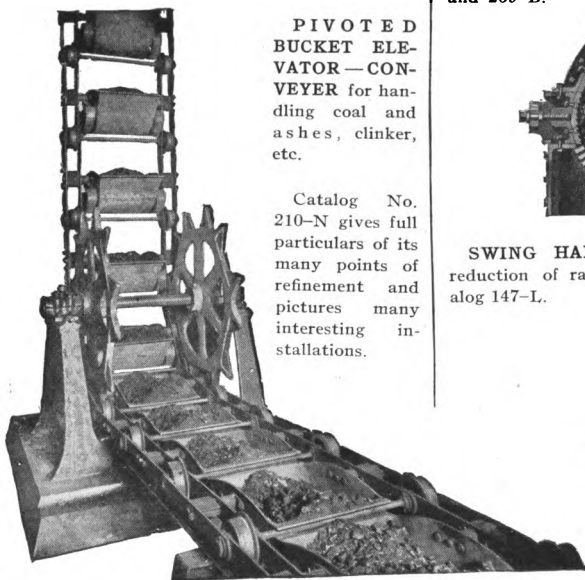
**ELEVATORS**—Tray, Barrel arm, Bucket, etc.

**CHAINS**—All types for elevating, conveying and transmission purposes; Sprocket wheels, etc.

**CRUSHERS, PULVERIZERS, SHREDDERS, PORTABLE LIME-PULVERS, ETC.**

**POWER TRANSMISSION MACHINERY**—Self-Propelling Loaders for handling loose material to wagons or trucks.

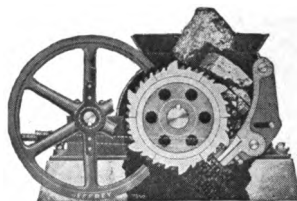
**COAL MINE AND TIPPLE MACHINERY EQUIPMENTS**, including Coal Cutters, Drills, Pit Car Loaders, Locomotives, Car Hauls, Screens, Elevators, Conveyers, Picking Tables and adjustable Loading Booms, Ventilating Fans, Crushers, etc.



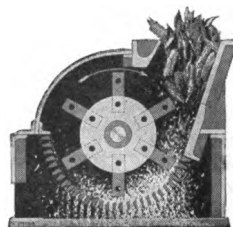
**PIVOTED BUCKET ELEVATOR**—CONVEYER for handling coal and ashes, clinker, etc.

Catalog No. 210-N gives full particulars of its many points of refinement and pictures many interesting installations.

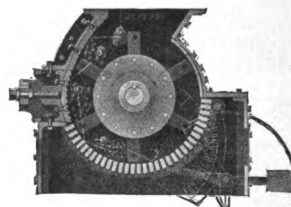
### Patented



**JEFFREY SINGLE ROLL COAL CRUSHER** for Mine, Power House and Coaling Station. Reduces lump and run-of-mine coal to stoker size in a single operation. Catalog No. 141-I.



**SWING HAMMER SHREDDER** for the preparation of fibrous materials. Catalogs 245-D and 259-B.



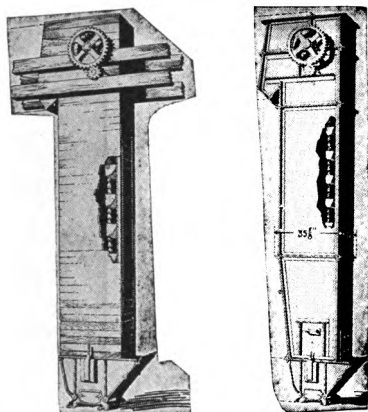
**SWING HAMMER PULVERIZER** for the reduction of raw and fibrous materials. Catalog 147-L.



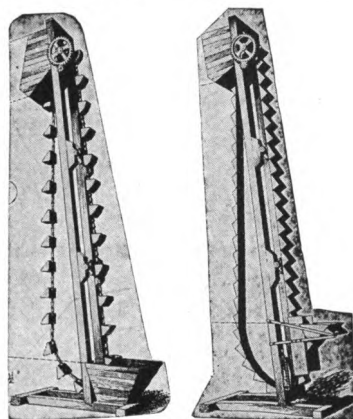
**DOUBLE ROLL CRUSHER** for reducing coal and coke. Bulletin No 248-D.

## THE JEFFREY MFG. CO.

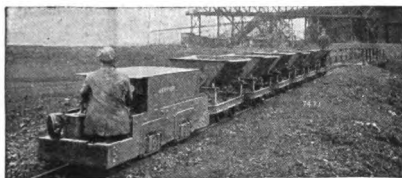
COLUMBUS, OHIO



Catalog No. 244-S on **JEFFREY STANDARDIZED ELEVATORS** contains over 40 pages of complete layouts and specifications.



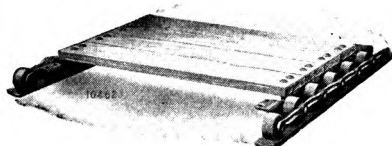
Catalog No. 175-W features **JEFFREY STANDARD BELT CONVEYERS** for handling ores, coal, sand and gravel, merchandise, etc.



**STORAGE BATTERY INDUSTRIAL LOCOMOTIVE.** Write for Catalog No. 231-K.

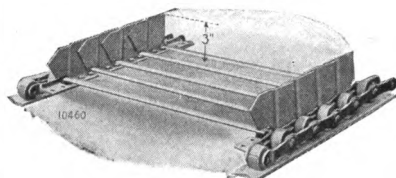


**SELF-PROPELLING DIGGER AND LOADER** for handling crushed stone, sand and gravel, acid phosphate, ashes, coal, coke, etc. Catalog 264-D.



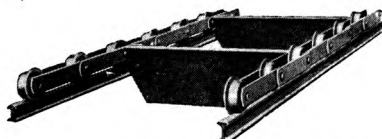
Wood Apron Conveyor

345



Steel Apron Conveyor

**JEFFREY STANDARD WOOD AND STEEL APRON CONVEYERS** for handling packages, bags, barrels, boxes, and loose materials are fully described in Catalog 258-L.



One of our standard types of **SCRAPER CONVEYERS** for handling coal, etc. Catalog 257-C.

Our Catalogs on the various types of Jeffrey Elevating and Conveying Machinery are text books, containing valuable information, data and layouts for Engineers.



## THE LAMSON COMPANY

GENERAL OFFICES

100 BOYLSTON ST., BOSTON, MASS.

REPRESENTATIVES IN  
ALL PRINCIPAL CITIES

WORKS  
LOWELL, MASS. TORONTO, CAN.

**Builders of Pneumatic, Selective and Mechanical Carriers and Conveyors**

### PRODUCTS:

Pneumatic Tube Systems, Belt Conveyors, Gravity Roller Conveyors, and Sweep-Off Carriers, Light Elevators and Lifts, Cable and Wire Line Message and Parcel Carriers.



Lamson Pneumatic Tube Desk in  
Central Planning Department

### SCOPE OF USE:

Lamson Pneumatic Carriers shoot papers, orders, mail, small tools and parts between departments and buildings. These mechanical messengers carry written orders cutting out the misunderstandings of oral messages. Quick as the 'phone, surer than the messenger boy. The ideal way to connect the planning department with superintendents, foremen and shippers.

Lamson Conveyors handle everything from tools and tote boxes to finished machines and boxed articles. They organize the whole plant so that material and partly finished parts move in an orderly stream from operation to operation.

Parcel Carriers and Light Elevators convey letters, packages, letter files, blue prints in offices and drafting room. Over three hundred different kinds of business use Lamson Carriers and Conveyors.

### CO-OPERATIVE SERVICE:

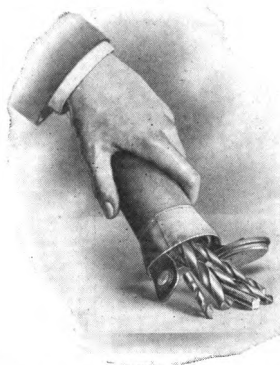
Engineers, manufacturers, architects will find Lamson engineers ready to co-operate in solving all problems calling for carrier or conveyor systems. Lamson experience and the complete information in the hands of Lamson men enable them to solve any problem, however complicated or extensive.

### LAMSON SYSTEMS:

The following are the principal standardized types of carriers and conveyor systems. While standard equipment will care for almost all conditions, special systems or modified systems are designed by Lamson engineers for unusual installations.

### Pneumatic Tube Systems:

Consist of tubes, terminals, and carriers operated by vacuum, or pressure, supplied by special power equipment, usually a motor-driven blower. Papers, requisitions, mail, small parts, and small tools are placed in a carrier and quickly delivered to the desired point or relayed from a central point.



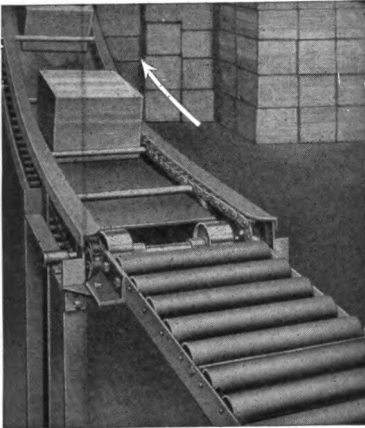
Tools and small parts are carried at lightning speed about the machine shop or manufacturing plant

## THE LAMSON COMPANY

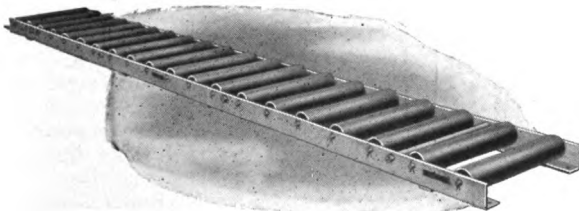
The installation may call for independent lines, or for a shifting current line in which two or more stations are intermittently operated by the vacuum of a single ingoing line. Or, the business may be most economically served by a Vacuum-Pressure Start and Stop System in which the motor remains idle until carrier is put into a tube at a sending point, when it automatically starts. It stops after the carrier arrives at its destination.

### Belt Conveyors:

Handle boxes, packing cases, loose material. Supplemented by automatic elevators and gravity chutes, they will handle material in any direction throughout the plant.



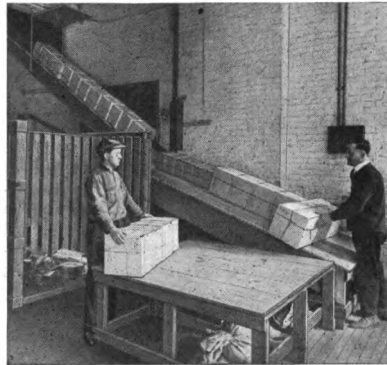
Boxes are carried by conveyor and automatic elevator to second floor—the stream flows up hill



Note the sturdy construction and compact appearance of this straight section of Lamson Gravity Conveyor

### Gravity Roller Conveyors:

For moving boxes, etc., and any object having one flat surface. Made up of a series of ball-bearing rollers in sturdy angle-iron frames which are set at a slight incline in order to utilize the force of gravity. Made in standard 10-foot lengths and in curved sections of any number of degrees. Supports for permanent installation or for use as portable conveyors. For moving shafting, pipe shells, the rolls are made spool-shaped.



Lower end of conveyor showing boxes coming down to the shipping room

### Lamson Elevators and Lifts:

Hand, pneumatic, and electrically operated. For simple, light delivery or varied heavy service.



### Lamson Wire-Line Parcel Carriers:

Save time in factories, stores, and commercial houses. Baskets shoot swiftly from station to station carrying merchandise, tools, etc. Car runs on wire track stretched taut between stations. Cord propulsion, or push types without propulsion for short lines. Made in Kick-Back form for one-way service—so arranged at the receiving station that the contents shoot out of the carrier into a receiver.

## MATHEWS GRAVITY CARRIER COMPANY

MAIN OFFICE AND FACTORY

ELLWOOD CITY, PA., U. S. A.

BRANCH FACTORIES:

PORT HOPE, ONT.

LONDON, ENG.

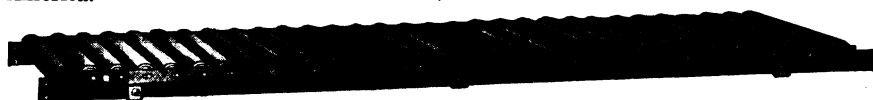
Branch Offices in all Principal American Cities

### MATHEWS ALL-STEEL, GRAVITY ROLLER CONVEYERS:

The First Steel, Ball-Bearing Roller Conveyers Manufactured and Used in America.

five and ninety degree. Special curves and special straight lengths made to order.

Rollers are  $2\frac{1}{4}$ " in diameter cut from 16 gauge, cold-drawn, seamless steel



### Portable Roller Conveyor Units:

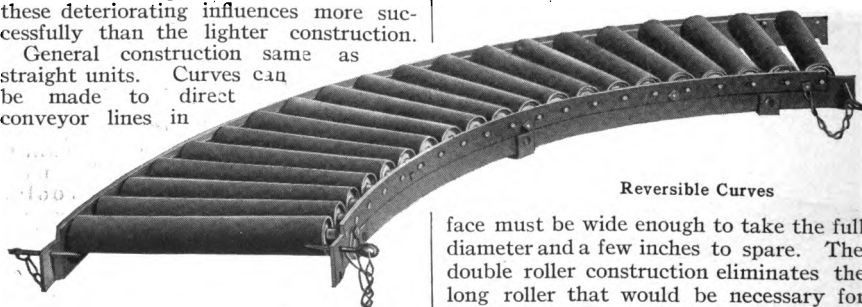
348 Above is shown a typical eight-foot unit. Rollers are spaced to suit sizes and weights of packages to be handled. Diameter of rollers,  $2\frac{1}{4}$  inches, cut from cold-drawn, seamless steel tubing, fitted with case-hardened, detachable ball bearings and full-length axles. Lock bars hold all rollers rigidly in place, eliminating use of nuts. Frame rails are of flat bar steel, rigidly braced crosswise and lengthwise. Whole unit construction is strong, neat, compact.

Mathews Roller Conveyers are also made in "Heavy Duty" type, the construction throughout being of heavier materials. Rollers are  $3\frac{1}{4}$  inches in diameter. This type is especially recommended where excessive moisture, salts and acids prevail, as it will resist these deteriorating influences more successfully than the lighter construction.

General construction same as straight units. Curves can be made to direct conveyor lines in

tubing, assembled in two parallel rows (alternated or "staggered") in a steel frame having a third rail through the center. The rollers are so assembled that the package or commodity is self-centering, doing away with guard rails. This is accomplished by advancing the outside ends of rollers a little ahead of inside ends. Rollers equipped with case-hardened, detachable ball-bearings and full length axles. Sections are provided with universal couplings when used portably and strap couplings for permanent installation.

Designed to convey boxes, crates or cartons of large size (but not excessive weight) and barrels (in upright position) on a grade of approximately 4%. Especially adapted for barrels as the roller sur-



Reversible Curves

any desired direction to fit special conditions or requirements. These curves are also made in "Heavy Duty" construction.

### Gravity Conveyors of Double Roller Type (Patented):

Straight lengths four and eight feet long; reversible curves in angles of forty-

face must be wide enough to take the full diameter and a few inches to spare. The double roller construction eliminates the long roller that would be necessary for barrels and provides a double number of bearings under the load, thus insuring greater strength and longer service.

The Mathews Double-Roller Conveyor is also furnished in "Heavy Duty" type to meet extraordinary requirements involving conveyance of boxes, crates, cartons and barrels of large sizes and heavy weights.

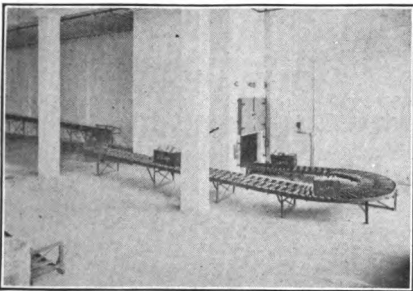
# MATHEWS GRAVITY CARRIER COMPANY

## GRAVITY ROLLER CONVEYERS:

To secure continuous routing, save rehandling, conserve floor space, eliminate waste of time and labor and to speed production and shipping, are the elements which make for efficiency in the handling of merchandise as well as a wide range of raw materials and finished products.

The principle of Gravity conveyance has been scientifically developed by Mathews engineers during fifteen years of continuous contact with conveying problems of every description, and today is being successfully applied to the handling of boxes, crates, cartons, barrels, kegs, trays, cans, drums, etc.

The Mathews specialty is Roller Conveyers, made of light and heavy construction and in single- and double-roller types. All parts are of high-grade steel—



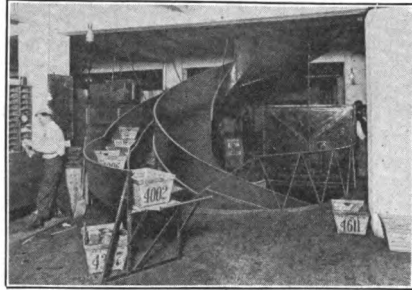
rollers are of cold-drawn seamless tubing, fitted with detachable ball bearings and through axles.

## CONVEYING SYSTEMS:

In studying the application of Gravity conveyance to factory, wholesale and warehouse use, certain limitations were encountered which resulted in the invention of other correlated conveying devices.

We now have complete systems for accomplishing continuous transportation of packages between all departments connecting all floors, and with extensions to adjacent buildings.

By means of Automatic Straight-Lift and Inclined Elevators, Gravity Roller Spirals, Gravity Spiral Chutes, Straight Chutes, Curves, Switches, Deflectors and Power Conveyers, operating in automatic relation to Gravity Conveyor lines, all



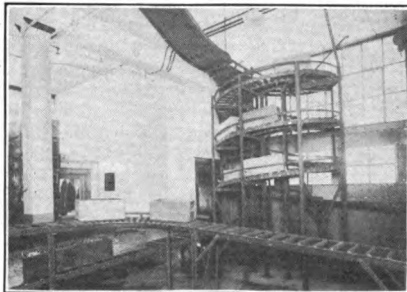
objective points can be linked together to conform to special or standardized routing plans, and designed to fit into existing structures without expensive alterations.

## GRAVITY SPIRAL CONVEYERS:

The adoption of the Gravity Spiral Conveyor as a substitute for platform elevators in handling down-coming merchandise has been almost universal in recent years, especially in large wholesale and retail establishments.

The Mathews Gravity Spiral Conveyers were not designed to meet low-priced competition but to insure permanency and low upkeep through employment of high-grade materials, correct structural designing and scientific fabrication. Made in several standard styles for inside or outside installation.

Where packages or products are fragile and liable to injury, a Mathews Double-Roller Spiral Conveyor (patented) may be substituted for the Spiral Chute. Roller Spirals control the movement of packages, eliminating breakage and damage, also permit accumulating and storing of packages without danger of jamming, or buckling.



(Continued on next pages)



(Continued from preceding pages)

## MATHEWS GRAVITY CARRIER COMPANY

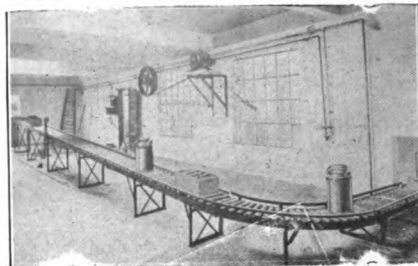
MAIN OFFICE AND FACTORY  
ELLWOOD CITY, PA., U. S. A.

### AUTOMATIC PACKAGE ELEVATORS:

The distribution of Merchandise packages from lower to upper floors or direct routing of freight from cars to various floors of factory or warehouse is being accomplished efficiently and economically by means of Mathews Automatic Straight-Lift and Inclined Elevators.

When used in automatic relation to connecting Gravity Conveyor lines these speedy elevators find their greatest sphere of usefulness and maximum efficiency. Equipped with positive package ejectors, carriage control, safety devices, power discharge stations, etc.

Handles boxes, barrels, crates, cartons, or any character of container having firm, substantial construction. Straight-Lifts



Roller Conveyor is, therefore, a product built upon a thorough knowledge of requirements—not mere theories.

This Conveyor is also being applied to the handling of Pig Iron, Billets, Forgings, Castings, Shells, Bars, Angles, etc.

350



are made in three standard sizes. Inclined types are simpler in design and generally employed for two-floor service only.

### HEAVY-DUTY ROLLER CONVEYERS:

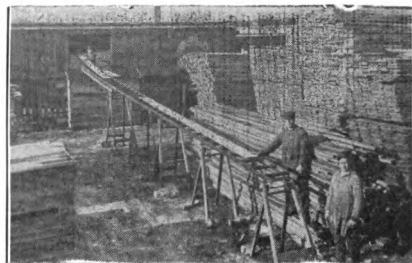
It frequently happens that the service required of a Gravity Roller Conveyor is of an unusually severe nature. The packages or commodities may run to extreme sizes and weights, or the installation may be surrounded by conditions which cause rapid deterioration, such as the presence of moisture, steam, acids and salts, usually prevailing in Dairies, Creameries, Ice Cream Factories, Meat and Fish Packing Plants, etc.

Our engineers made a careful investigation of these adverse conditions and conducted a series of chemical and mechanical experiments covering a period of several months. The Mathews Heavy-Duty

### PATENTED LUMBER CONVEYERS:

Almost the first Gravity Conveyor put on the market years ago was the Mathews Gravity Lumber Conveyor (patented). Construction consists of two parallel rows of steel, ball-bearing rollers assembled in 12' steel units having three frame rails. The rollers are so arranged that lumber will not run off, although no guard rails are used.

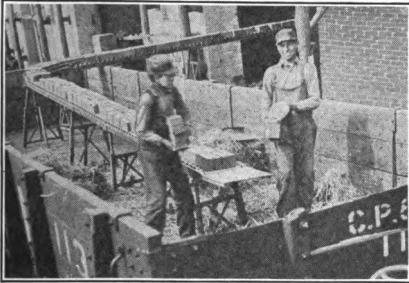
Units are provided with universal couplings the same as our other styles of portable conveyers; boards of any width or length can be sent over these rollers in any desired direction—around corners or through tight places where teams cannot go—using a down grade of only four per cent. 90° and 45° curves are also furnished when needed for proper routing to desired destination.





## MATHEWS GRAVITY CARRIER COMPANY

### PATENTED BRICK CONVEYERS:



The Mathews Gravity Brick Conveyor (patented) is another labor-saver which has won popularity and a prominent place in plants where clay, concrete and cement products are made. As a substitute for wheelbarrows this conveyor has been approved and adopted by hundreds of brick makers throughout the country. All of the leading steel and iron mills are using thousands of feet for quick handling of fire brick, while prominent supply houses and contractors are reducing their pay rolls and speeding up their work through the employment of our method for conveying building materials.

Rollers are steel, with ball bearings, and have flanges at each end which act as guard rails, without creating friction. Units are furnished in straight lengths 4' and 8' long, also 90° and 45° curves, all equipped with universal couplings for portable use. Conveyers are made in standard widths of 8", 10", 12", 14" and 16". Brick can be handled two, three, four or five abreast, or large building blocks and fire brick shapes can be handled as single units—"Indian file."



### HANDLING BUILDING SUPPLIES:

The handling of Cement, Wall Plaster, etc., in sacks, is being successfully and economically accomplished by means of the Mathews Gravity Roller Conveyor, and is being used today by many retailers, wholesalers and manufacturers, as well as prominent building contractors.

The practice is to place the sacks on wood pallets of suitable size to hold anywhere from one to six, these pallets interposing a sufficiently hard, smooth surface to insure movement by gravity on a grade as low as three per cent. The return of the pallets to the starting point is a simple matter, being quickly accomplished by stacking them on the conveyor and pushing them back, up-grade. Our customers report savings in time and labor varying from twenty-five to fifty per cent.

Units are furnished in straight and curve sections in lengths and weights suitable for portable use, and constructed of high-grade steel throughout. 351

### NOTICE TO ENGINEERS:

Sales and engineering offices are maintained in all the leading cities in charge of experts who are available for consultation on short notice. Branch office services are rendered without cost or obligation, and engineers are urged to make full use of the facilities we have provided.

In cases where correspondence with the home office is preferable full details concerning conveying problems should be submitted in first letter, accompanied by pencil sketches or blueprints showing the objective points to be connected by conveyor units, distances, elevations, etc. A full list of packages, articles, materials or commodities should also be furnished, including general description of same and surface dimensions and weights of each size. This data are absolutely essential to intelligent consideration of any conveying requirements, and strict compliance with these instructions will enable us to prepare drawings and proposals without necessary loss of time.

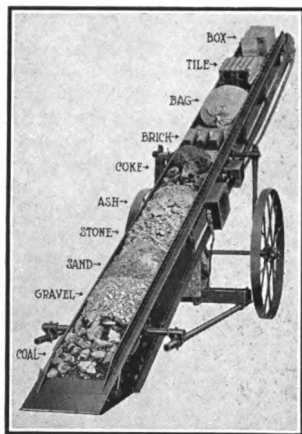


# PORTABLE MACHINERY CO. INC.

PASSAIC, N. J.

## THE SCOOP CONVEYOR:

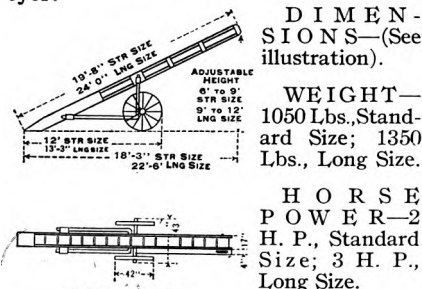
The Scoop Conveyor is an exclusive type of light-weight portable belt conveyor designed to be handled by one man and to assist the hand shoveler in moving loose materials such as coal, coke, ashes, crushed stone, sand, gravel, etc. It will also handle sacks, packages, boxes and manufactured products.



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We call it Scoop Conveyor because the carrying belt receives its load over a scoop which can be pushed or completely buried into the material to be conveyed. This exclusive feature can be found on no other belt conveyor. The *time, labor and money saving* features of the Scoop Conveyor are so apparent that a few figures will enable you to arrive at its saving over your present operating costs.

## Specifications of Type "A" Scoop Conveyor:



GUARANTEE—We guarantee the

carrying belt to handle at least 5000 tons of coal or 4000 tons of ashes or sand, making cost of belt renewals less than one cent per ton on coal and slightly over one cent per ton on ashes or sand.

In asking for further information, give full operating conditions, kind of material to be handled, from where will machine receive ma-

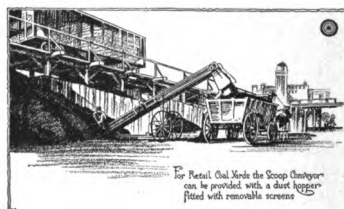


terial, to where will machine deliver material, kind of power available, etc.

Machines can be furnished with either electric motor or gasoline engine. We furnish motor installation instructions and carry in stock drive reductions for any motor speed from 700 R. P. M. to 1800 R. P. M.

## Capacity and Method of Feeding:

The carrying capacity of the Scoop Conveyor based on handling coal is one ton in one minute, providing a sufficient amount of coal is maintained at the receiving end of the machine. If the storage pile is of considerable height, one



man can readily feed one ton in one and one-half minutes. If the pile is low, he will require anywhere from two to four minutes to feed one ton. Where speed is required under unfavorable conditions two men may be provided for feeding.

In unloading hopper bottom cars the machine can be readily supplied to its full capacity of one ton per minute.

Large size coal, foundry coke and crushed stone fed from storage pile by one man requires anywhere from three to six minutes to feed one ton, or half that time if fed by two men.

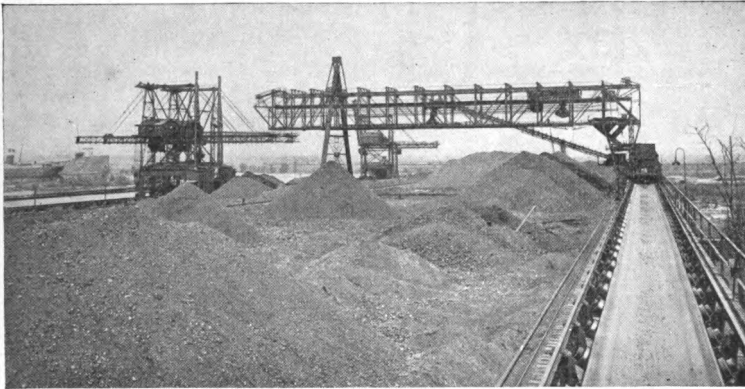


## ROBINS CONVEYING BELT CO.

Manufacturers of Conveying Machinery

PARK ROW BUILDING, NEW YORK

SALT LAKE CITY: Newhouse Bldg. CHICAGO OFFICE: Old Colony Bldg. PITTSBURGH: Union Arcade Bldg.  
BIRMINGHAM: C. B. Davis Eng. Co.  
SAN FRANCISCO: The Griffin Co. TORONTO: Gutta Percha & Rubber, Ltd.



Robins Unloading, Stocking, Reclaiming and Conveying Equipment

The Robins Conveying Belt Company is prepared to design and install conveying machinery to meet any requirement. We furnish belt conveyors, unloading towers, stocking and reclaiming bridges, coal storage and reclaiming systems, coke cooling wharfs, ore bedding and reclaiming systems, standard and adjustable coal or coke crushers, and the auxiliary equipment such as chutes, feeders, screens of various types, etc.

Our machinery is handling coal, coke, ashes, ore, limestone, clinker, cement in bulk and in bags, wet concrete, sand, crushed stone, dirt, gypsum, phosphate rock, salt, grain, wood chips and pulp, rubbish, packages of all kinds and many other materials.



Robins Standard Troughing Idler

Our machinery parts are fitted for compression grease cup lubrication to protect the bearings from dust and corrosion. Consequently, troubles resulting from these causes are practically eliminated under the most severe operating conditions.

We manufacture a number of different grades of conveyor belting, both of the stepped-ply and straight-ply construction, each grade being designed to give the most economical service under certain operating conditions. If we believe that none of our brands of belts will give satisfactory service because of unusual conditions, we will manufacture a special grade of belt for the work. 353



Robins Stepped-Ply Conveyor Belt

Our stepped-ply belts have thicker rubber cover in the center than at the edges, thus giving more protection where the abrasion is greatest. A belt of this construction is flexible laterally, allowing it to conform to the shape of the troughing idlers, and causing it to run true even when empty.

Our "Handbook of Conveyor Practice" will prove of value to engineers who are planning for or designing conveyor installations. It contains a group of useful tables concerning capacities, power requirements, speeds of conveyors and similar matter; dimensions of conveyor parts, together with general data on conveyor practice. We will be glad to send a copy on request.

*Elevating, Conveying and Power Transmission Machinery*

## WELLER MANUFACTURING CO.

GENERAL OFFICE AND WORKS

1820-1856 N. KOSTNER AVE., CHICAGO

BRANCH SALES OFFICES

NEW YORK

PITTSBURGH

BALTIMORE

BIRMINGHAM

SALT LAKE CITY

SAN FRANCISCO

Trade



Mark

Designers and Manufacturers of Standard and Special

ELEVATING, CONVEYING AND  
POWER TRANSMITTING MACHIN-  
ERY for:

Cement Mills

Stone and Ore Crushing Plants

Coal Handling Systems

Sand and Gravel Washeries

Fertilizer and Phosphate Mills

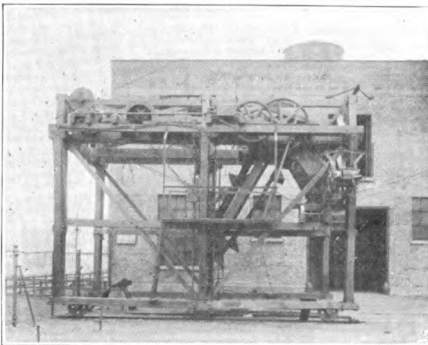
Grain Elevators and Flour Mills

Cotton Oil and Cotton Mills

Starch and Glucose Factories

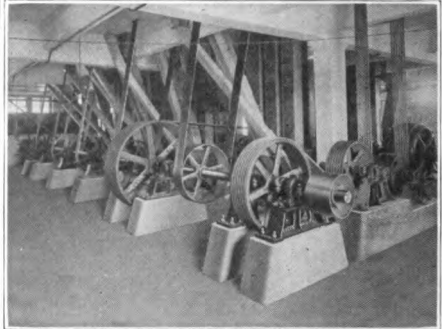
Tanneries and Brick Yards

Glass Plants, Paper Mills, etc.



THE WELLER GONDOLA CAR UNLOADER

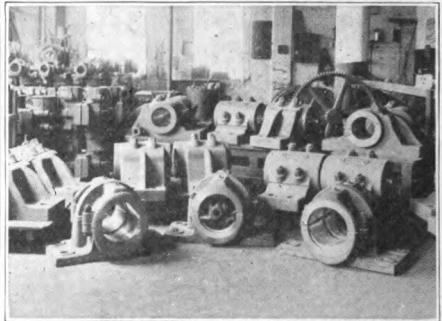
Will handle run-of-mine and smaller coal, sand, gravel, etc., at the rate of about one car per hour.



HEAVY LINE SHAFT EQUIPMENT  
Mounted on Iron Floor Stands

We manufacture the following products in many styles and forms to supply your individual needs.

Bearings, Collar	Coal Crushers	Gears
Oiling	Clutches	Hoists
Belt Conveyors	Conveyors	Pulleys
Buckets, Elevator	Dryers	Rope Drives
Car Pullers	Elevators,	Sheaves
Car Unloaders	Bucket	Shovels(power)
Screens		Spouts

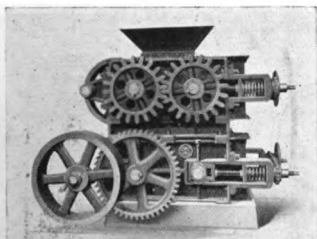


HEAVY BEARINGS AND TRANSMISSION  
EQUIPMENT

Our bearings are suitable for the heaviest types of transmission or haulage. Built for slow or fast moving shafts.

Every member of The A. S. M. E. should have our **General Catalogue N-35**, the most complete volume ever published on Elevating, Conveying and Power Transmitting Machinery.

## WELLER MANUFACTURING CO.



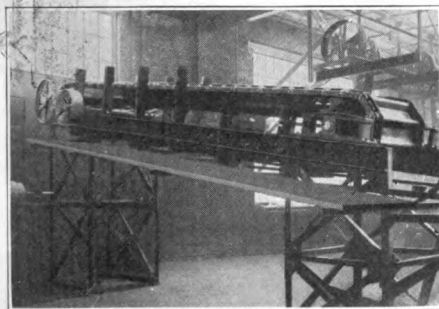
### COAL CRUSHERS

The heaviest, simplest and most efficient coal crusher on the market.



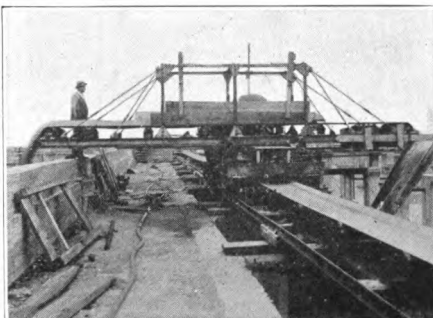
### BELT CONVEYORS

For coal, stone, gravel, ore or any other loose material regularly made from 12 to 60 inch wide.



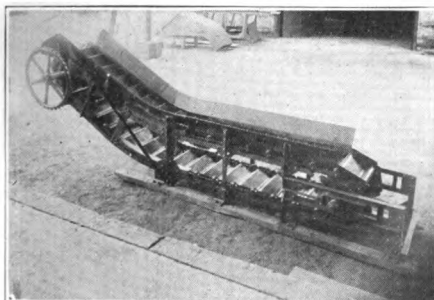
### SELF-CONTAINED PICKING TABLES, STEEL FRAMES

We build these apron conveyor picking tables either wood lined or otherwise in any width up to 100 inches for coal or metal mines.



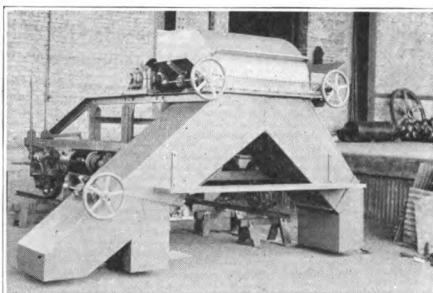
### SHUTTLE TRIPPER FOR BELT CONVEYOR

Arranged to spread materials on either side of main belt conveyor. We have built this tripper with a spread of 120 ft.



### SELF-CONTAINED APRON CONVEYOR FEEDERS

Especially adapted for fitting to bottom of track hoppers and feeding materials to crushers, elevators or conveyors.



### HEAVY STEEL FRAME BELT TRIPPERS

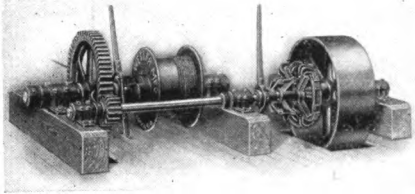
Fitted with three-way spouts and interlocking device to positively prevent choking of one spout while changing discharge to another opening.

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(Continued from preceding pages)

## WELLER MANUFACTURING CO.

CHICAGO



### WELLER CAR PULLERS

Designed to handle from one to fifty loaded cars.

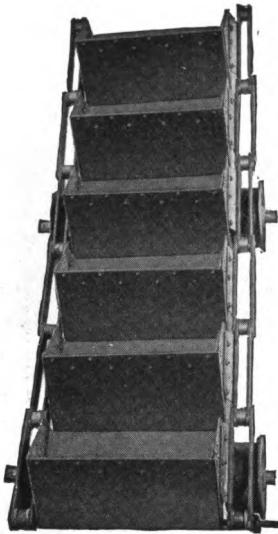


### BUCKET ELEVATORS

Built in any style with steel or wood casings, any type of buckets fitted to chains or belts according to requirements of materials, capacity and conditions.



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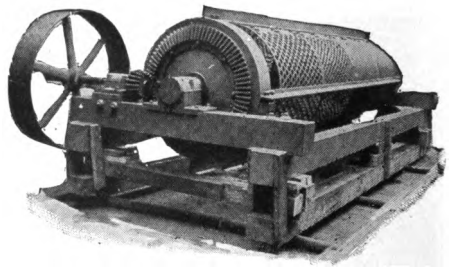
### HEAVY BUCKET ELEVATORS

Built in any size buckets and any pitch of chain up to 96 inches wide buckets and 36 inch pitch of chain for elevator up to 200 ft. centers.



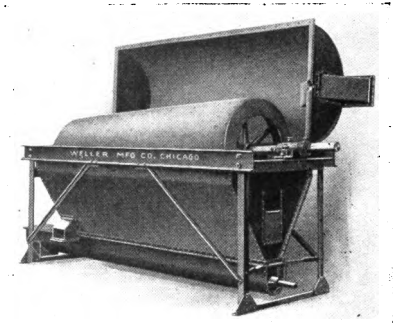
### COLD ROLLED SPIRAL CONVEYOR

With steel boxes, regularly made from 4 to 30 inches in diameter.



### REVOLVING SCREENS

Of every description, either open or enclosed. Designed to handle anything from talcum powder to crusher run ore, any capacity up to 1000 tons per hour.



## STANDARD CONVEYOR CO.

Formerly Minnesota Manufacturers' Assn.

OFFICE AND FACTORY: NORTH ST. PAUL, MINN.

EASTERN OFFICE:  
New York City  
7th Floor, 227 Fulton St.

DETROIT OFFICE:  
Detroit, Mich.  
400 Penobscot Bldg.

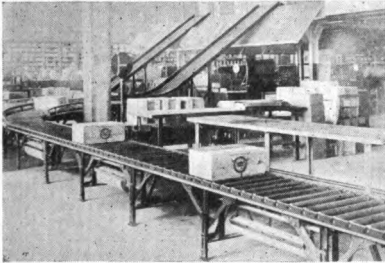
CHICAGO OFFICE:  
549 W. Washington St.

Representatives in all Principal Cities

**Manufacturers of Gravity Roller Conveyor, Automatic Straight Lift Elevator, Inclined Elevator, Gravity Spiral Chute, and Power Conveying Machinery for the Indoor Transportation of Boxed, Cased, and Packaged Merchandise**

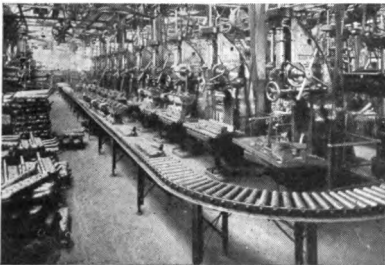
### STANDARD GRAVITY ROLLER CONVEYORS:

Are constructed of  $2\frac{1}{2}$ " dia. either steel or maple rollers; ball-bearing, side frames of  $2\frac{1}{2}$ " x  $2$ " x  $\frac{1}{4}$ " angle iron.



Portion of Indoor Transportation System

This type of conveyor, placed on 4% grade, conveys by gravity boxed and cased merchandise, lumber, brick, pig iron, and all commodities having one hard smooth surface to rest on the rollers.



Conveying Castings to and from Machine Operators on Standard Roller Conveyor

### STANDARD GRAVITY SPIRAL CHUTES:

Are constructed on a scientific basis, permitting commodities of various forms, sizes, and weights to be lowered at a uniform rate of speed.

Standard Spiral Chutes are used for the economical lowering of merchandise from upper floors to lower floors.

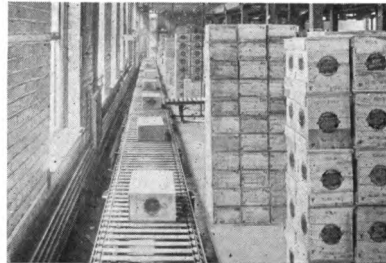
### STANDARD COMBINATION SYSTEMS:

Are comprised of Standard Gravity conveyor sections, Gravity spiral, automatic inclined power elevator, or power slat conveyors.

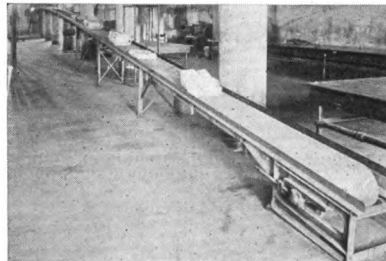
The combination of these units makes an ideal indoor transportation system reaching every part of warehouse, yard, or plant.



Standard Gravity Spiral Chute Lowering General Merchandise



Standard Combination Gravity and Power Slat Conveyor System



Conveying Bundles of Newspapers on Standard Belt Conveyor

WHATEVER—WHEREVER your conveying or handling problems are, there is a Standard Service at your command.

Experienced and practical engineering knowledge is back of every lay-out, drawing, or design submitted by our conveying efficiency engineers.



# THE AUTOMATIC TRANSPORTATION COMPANY

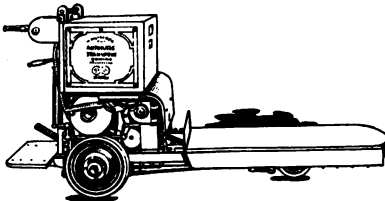
OFFICE AND FACTORIES, BUFFALO, N. Y.

Representatives in All Principal Cities

Pioneer and World's Largest Manufacturer of Electric Freight, Industrial and Baggage Trucks, Tractors and Engines

## EFFICIENT INTERPLANT TRANSPORTATION:

The illustrations here show three representative types of "Automatic" transportation devices. There are many

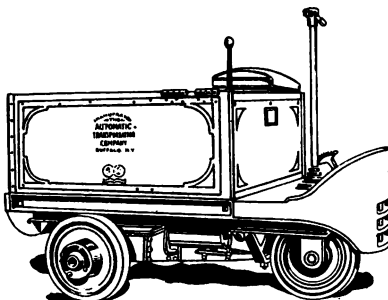


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"Type L" Electric Lifting Platform Truck

standard types—one to perfectly meet every condition and to prove a practical economy in interplant transportation.

Many installations are saving the wages of three to twelve men or more and doing the work quicker and better.



"Type T" Tractor



"Type E" Industrial Truck

Automatic equipment has become standard in many industries, and practical experience has proven its decided superiority.

This company, after careful study of requirements, has perfected and standardized many different types. Under some conditions the load-carrying truck serves best; in others the tractor trailer system is more efficient; while under still different conditions greatest savings may be effected by the use of hopper trucks or electric elevating platform trucks.

Aside from the very considerable savings effected in the cost of moving material the question of labor is a most important factor in favor of the installation of Automatic equipment.

A complete catalog showing all standard models is yours for the asking—you will find it mighty interesting.

Write for your copy today.

*Correspondence invited.*

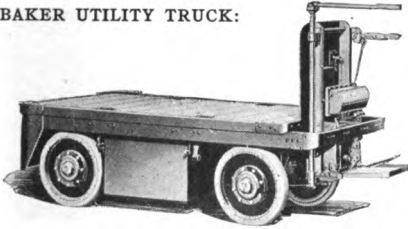


# THE BAKER R & L COMPANY

CLEVELAND, OHIO

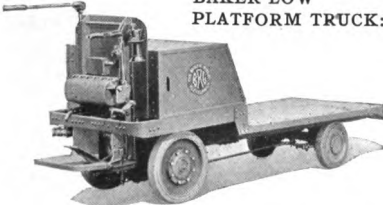
Manufacturers of Baker Industrial Trucks and Tractors and Raulang Electrics

**BAKER UTILITY TRUCK:**



4000-pound load-carrying truck, electrically driven, two or four-wheel drive, four-wheel steer.

**BAKER LOW PLATFORM TRUCK:**



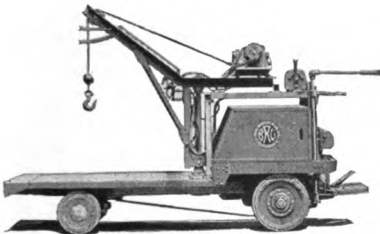
4000-pound capacity load-carrying truck, electrically driven, two-wheel drive, four-wheel steer.

**BAKER ELEVATING TRUCK:**



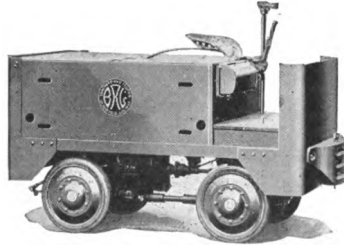
4000-pound capacity load-carrying truck of elevating platform type, electrically driven, two-wheel drive, four-wheel steer. An auxiliary electric motor elevates and lowers the load platform 5' in 10 seconds.

**BAKER SWIVEL HOIST TRUCK:**



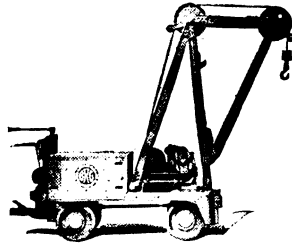
Truck capacity 4000 pounds, hoist capacity 1000 pounds or 1500 pounds; truck and hoist both electrically driven by separate motors.

**BAKER INDUSTRIAL TRACTOR:**



Rated drawbar pull 400 pounds, starting drawbar pull 1500 to 3000 pounds; two- or four-wheel drive, four-wheel steer. Speed 2 to 7 M. P. H. Will haul a trailing load of from 10 to 20 tons.

**BAKER STACKING CRANE:**



359

Maximum capacity 4000 pounds, maximum radius 59", lift 150". Both truck and hoist driven by separate electric motors.

**BAKER CARRYING CRANE:**

4000-pound capacity; both truck and hoist driven by separate electric motors.

**BAKER DUMP BODY TRUCK:**

Capacity 1 yd., side dump; truck electrically driven.

## INTERSTANDARDIZATION OF PARTS BETWEEN MODELS:

98% of all parts on all models are identical and interchangeable. This reduces manufacturing costs and stocks of spare parts. In emergencies complete units may be transferred from one truck to another.

## DESIGN AND CONSTRUCTION:

All parts are ruggedly constructed to meet the most severe usage. Every part has been specially developed for its particular service by engineers who have been building electric vehicles for more than twenty years.

*Specifications and Descriptive Matter Furnished upon Request.*

## MERCURY MANUFACTURING CO.

4118 SOUTH HALSTED STREET, CHICAGO, U. S. A.

### REPRESENTATIVES IN

BOSTON  
ALBANY  
NEW YORK  
PHILADELPHIA

RICHMOND  
SAVANNAH  
BUFFALO  
PITTSBURGH

CLEVELAND  
COLUMBUS  
DETROIT  
CHICAGO

MILWAUKEE  
MINNEAPOLIS  
OMAHA  
LOS ANGELES

The Pioneer Designers, Developers, and Builders of "The Trackless Train" System of Industrial Haulage and Internal Transportation. Manufacturers of Industrial Tractors and Trailers. Plant Transportation Engineers

### DEFINITION:

To define the Mercury Tractor from the point of use, it is only necessary to say that it is designed to pull trackless trains of trailers without the limitations as to pathway which constrict such devices as the industrial railroad or the belt conveyor. Instead of carrying, it is designed to pull or push loads.

With respect to construction it is a trackless locomotive driven by an electric motor which obtains its current from storage batteries contained in the body of the tractor. In aiming to make it useful in industries where it must work in narrow aisles, difficult alcoves, tunnels, and doorways, the Mercury Tractor is designed to have a compacter body and a smaller turning radius in proportion to its battery capacity, than any similar device.

The function of the Mercury Tractor is to introduce a more efficient and economical method of materials-handling.

Mercury Tractors are not merely machines, but power units of a transportation system from which they cannot be dissociated.

### SPECIFICATIONS:

#### Mercury Type L 3:

**Frame:** Consists of one piece of four-inch channel iron bent to shape and welded to form a continuous piece. Other frame members consist of four-inch channels and three-inch channels disposed and fastened in such a way as to give maximum rigidity.

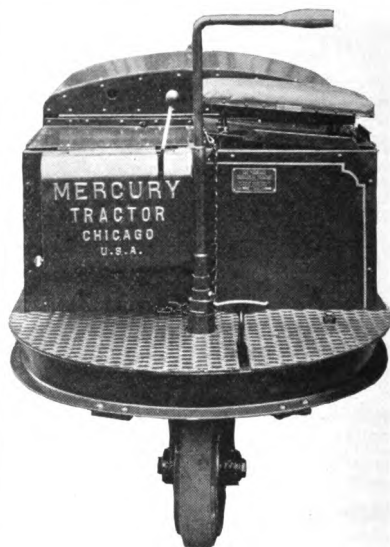
**Steering:** Is accomplished by a lever handle directly attached to the front wheel.

**Control:** A drum type controller, having three speeds forward and three reverse, is used.

**Motor:** Is of series type specially designed for tractor service.

**Drive:** Is direct from the motor through a high efficiency reversible worm gear to the rear axle.

All bearings throughout are Timken with the exception of motor shaft bearings, which are standard radial ball type.



Mercury, Type L 3 (3 Wheel Model)

Overall length.....	68"
Overall width.....	39"
Height to hood top.....	45"
Wheel base.....	39"
Tread rear.....	29 3/4"
Height from floor.....	17 1/2"
Turning radius, outside frame.....	56"
Size front tires.....	15" x 3 1/2"
Size rear tires.....	20" x 3 1/2"
Speed (maximum) with no load, M. P. H.....	7 1/2

# MERCURY MANUFACTURING CO.

## Mercury Type L 4:

Construction and design the same as Type L 3 except that it has two front wheels instead of one, using Mercury Special Steering Device which gives minimum turning radius.



Mercury, Type L 4 (4 Wheel Model)

Overall length.....	68"
Overall width.....	39"
Height to hood top.....	45"
Wheel base.....	39"
Tread, front.....	23 1/2"
Tread, rear.....	29 1/2"
Height, from floor.....	17 1/2"
Turning radius.....	71"
Size front tires.....	15" x 3 1/2"
Size rear tires.....	20" x 3 1/2"
Speed (maximum) with no load, M. P. H.....	7 1/2

## GENERAL DESCRIPTION:

Both Mercury Type L 3 and L 4 have the following features in common.

**Brakes:** Brake is operated by a foot pedal and contracts on a drum mounted on the worm shaft, giving powerful breaking effect and small wear on brake parts. The brake is also actuated by a spring controlled by the driver's seat so that brake is automatically set whenever driver is off the seat.

**Painting:** Framework and inside of hood are painted with black preservative paint. Wheels are painted red and varnished. Hood and frame are painted two coats dark blue and given one coat of varnish.

**Coupling:** The tractor is regularly equipped with three U-bolts on rear of frame for chain or stiff hitches. Coup-

ling can also be arranged in front if desired. The Mercury Company are also prepared to equip the tractor, at a small additional cost, with a variety of special couplers, both manual and automatic, when the advantage to be gained by the use of a special coupler is apparent.

**Signal:** Tractors are equipped with single stroke bell operated by foot push as a warning signal. Klaxon horn operated by foot can be supplied if desired.

**Fender:** A one-quarter-inch boiler plate fender bolted to the front of the frame will be furnished when specified. This fender extends 12" above driver's platform and 12" below, extending across the front of the machine.

**Cushion:** Each tractor is furnished with one spring upholstered cushion for driver's seat.

**Batteries:** Mercury Tractors are designed to operate equally well with either alkaline or lead batteries. The maximum battery capacity is 42 A-8 Edison cells or 24, 27 plate lead batteries.

**Safety Features:** The brake is automatically set when driver leaves his seat. The controller is also automatically returned to the "off" position by a spring which comes into action when the driver leaves his seat.

## ADAPTABILITY:

The Mercury Tractors and "The Trackless Train" are now doing efficient work in many industries, a partial list of which follows:

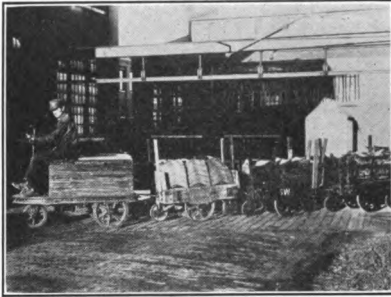
Express Companies	Munition Plants
Chemical Companies	Lumber Companies
Steel Companies	Mercantile Houses
Electric Plants	Packing Houses
Railways	Paper Mills
Tobacco Companies	Leather and Shoes
Sugar Refineries	Roofing Companies
Automotive Plants	Smelters
Cold Storage Warehouses	Cotton Mills
Agricultural Implement Works	Foundries
Oil Companies	Soap Manufacturers
Glass Companies	Tire Companies
Glass Works	Municipalities
Government Institutions	Paint Makers
United States Post Office	Woodenware

(Continued on next page)

(Continued from preceding pages)

## MERCURY MANUFACTURING CO.

4118 SOUTH HALSED STREET, CHICAGO, U. S. A.



In an Industrial Plant Handling  
Steel and Iron Parts

### ECONOMY:

The tractor permits the reduction of power units to a minimum and makes possible the use of trucking equipment already owned, because trucks are converted into trailers at little expense by the application of simple hitches designed by the Mercury engineers.

The tractor moves from 10 to 40 times as much as the hand trucker; works in equally congested places as the hand trucker, and at twice the speed; can transfer its freight from one load to another without loss of time, and costs for interest, depreciation, oil, grease, repairs, current, etc., an amount equal to approximately the wage of an ordinary laborer.

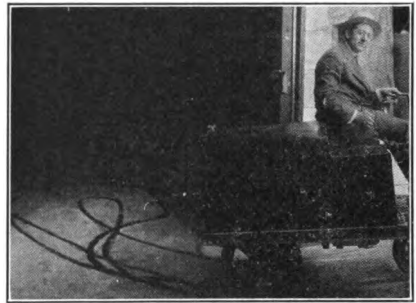
### FLEXIBILITY:

Under flexibility can be cited the diverse industries in which the Trackless

Train can be used, the remarkable ability to track because of the special couplings and hitches. It is not confined to any set, prescribed pathway, but can move to and from any part of a plant, where there is aisle room sufficient for an ordinary hand trucker.

### OPERATING EFFICIENCY:

Maximum operating efficiency is attained by virtue of the fact that the power unit works all of the time, and can be instantly uncoupled from one load and transferred to another without loss of loading and unloading time.



Turning Around in a Box Car

### EASE OF OPERATION:

An inexperienced trucker, or even an office girl, has been taught to operate a machine after an hour's instruction.

### SAFETY:

Attention can be pointed to the feature which causes an automatic shutting off of brakes whenever the driver leaves his seat. The risk is naturally reduced, also, because of the fact that a smaller number of trips must be made in comparison with any other method of haulage. Again, while loaded hand trucks with much momentum are impossible to stop quickly, the heaviest load can be stopped almost instantly, when being moved by the tractor.



Coming out of a Box Car

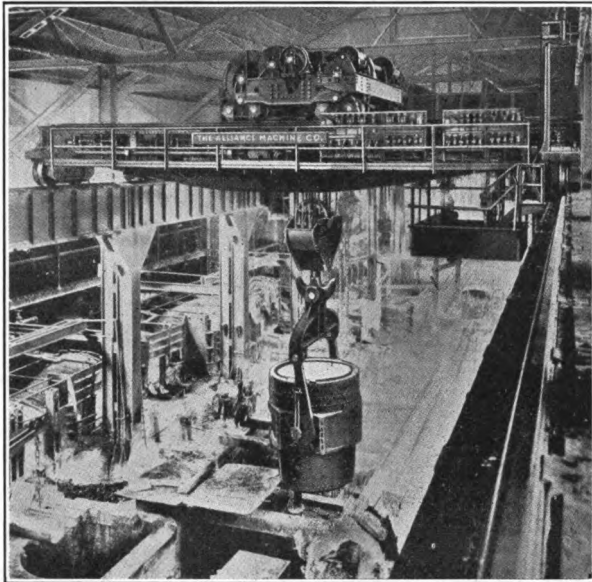
# THE ALLIANCE MACHINE COMPANY

ALLIANCE, OHIO

PITTSBURGH

BIRMINGHAM

Engineers and Builders of Electric Traveling Cranes and Machines of All Types for All Purposes; Ore Bridges; Rolling Mill and Hydraulic Machinery; Riveters, Steam Hammers, Heavy Punches and Shears; Coke Plant Machinery, Scale Cars and Charging Larries; Copper Converting Machinery



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## "ALLIANCE" ELECTRIC TRAVELING CRANES:

The above illustration shows a 200-Ton Single Trolley Crane Ladle design furnished by us for Carnegie Steel Co. A duplicate of the above crane has recently been installed without a single change.

To substantiate the claim that the Alliance Machine Co. is the largest builder of the World's Largest Cranes, we submit the following list of large and special cranes designed, built and in operation:



3-430 ton capacity, 90 ft. span.

### Heavy Cranes

56.....	75 Ton	29.....	125
9.....	80	19.....	150
1.....	90	12.....	175
50.....	100	2.....	200
2.....	115	1.....	250

### Soaking Pit

10.....	5 Ton
9.....	7½
4.....	10
5.....	12½
11.....	15
2.....	20
3.....	25

### Slab Chrg. Mchs. Crane & Floor Type

11.....	1 Ton
4.....	2
8.....	3½
11.....	5
8.....	8
4.....	15

### Strippers

7.....	100 Ton
17.....	150
10.....	200
1.....	320

### Combination Chargers & Strippers

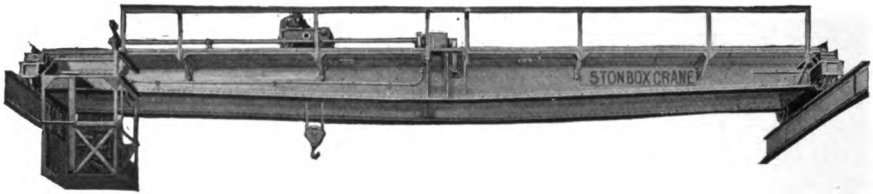
2.....	100 Ton
3.....	150
4.....	200

## **ALFRED BOX & COMPANY, INC.**

Established 1878

PHILADELPHIA, PA.

**Electric Traveling Cranes, Jib Cranes, Grab Bucket Cranes, Hand Traveling Cranes  
Monorail Systems, Electric Hoists, Trolleys, Chain Hoists and Electric Winches**

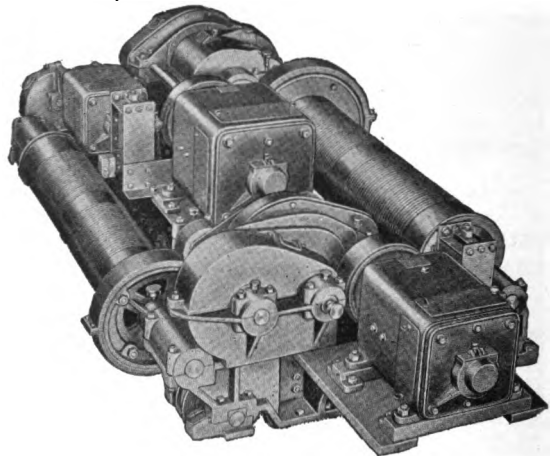


### **THE STANDARD BOX CRANE:**

364 Is built to meet the requirements for a good rugged crane. As built at present there are several features which commend it to the buying public.

Our Standard Trolley which is the heart of the crane represents the development of years in this particular line. Incorporated in the design will be found all the best features of modern practice—all gear trains except drum gear and pinion are assembled in gear boxes and mounted on the trolley housings as separate units—all gears steel and totally enclosed, yet readily accessible. Gear covers removable for inspection of working

parts without disturbing operation of crane—trolley wheels fast to axles revolving in M. C. B. type bearings—drum flanged to prevent rope running off.



### **STANDARD 30-TON HOISTING TROLLEY:**

With auxiliary hoist. Note clean-cut design—rugged construction throughout and the method of enclosure of working parts.

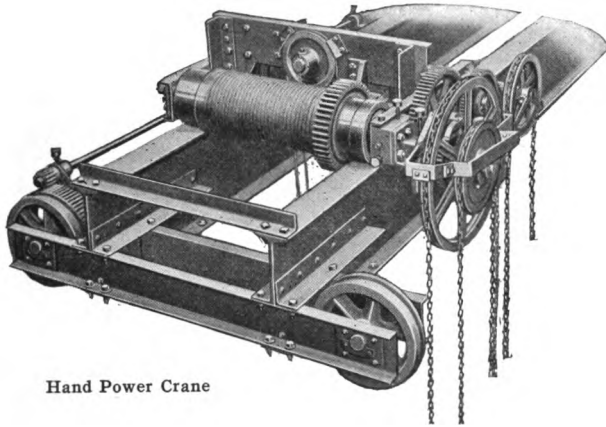
*Hand Traveling Cranes, Monorail Cranes, Jib Cranes*

## **ALFRED BOX & COMPANY, INC.**

Established 1878

PHILADELPHIA, PA.

**Electric Traveling Cranes, Jib Cranes, Grab Bucket Cranes, Hand Traveling Cranes, Monorail Systems, Electric Hoists, Trolleys, Chain Hoists and Electric Winches**

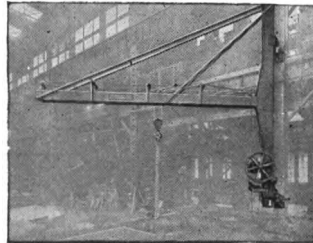


Hand Power Crane

### **HAND POWER TRAVELING CRANES:**

Any capacity or span. Illustration shows our improved wire rope and drum type.

This is, we believe, the easiest running, most substantially constructed hand operated crane on market today.



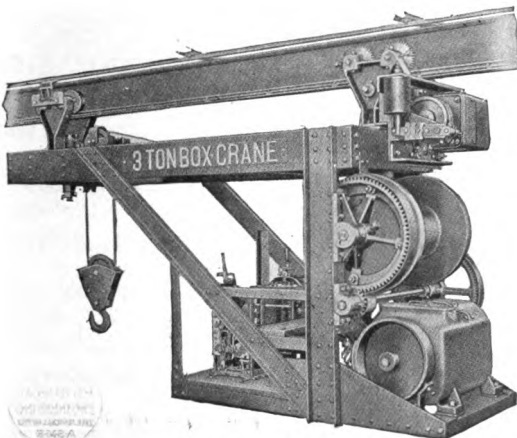
365

7 1/2 Ton Electric Jib Crane

Jib Cranes of all types and capacities.

Electric Hoists 1/2 to 10 tons capacities.

*We would be glad to send our catalogue.*



Heavy Duty Monorail Crane Designed for High Speed Continuous Operation

# THE BROWN HOISTING MACHINERY COMPANY

CLEVELAND, OHIO

NEW YORK: 50 Church St.  
CHICAGO: 208 S. LaSalle St.

PITTSBURGH: Oliver Bldg.  
SAN FRANCISCO: Monadnock Bldg.

Engineers and Manufacturers of Locomotive Cranes, Heavy Dock Machinery, Bridge Cranes, Etc., as well as smaller Cranes and Hoists

## BROWNHOIST

### COAL AND ORE HANDLING MACHINERY:

Bridge tramways, fast plants, cantilever cranes, gantry cranes, furnace hoists, larries, transfer cars, bins, car tipples, and pig iron breakers. These machines are designed for the rapid handling of material and a long service. They are installed in many parts of the world.

### LOCOMOTIVE CRANES:

366 Eight- and four-wheel and for any gauge track; speediest locomotive crane built; equipped with M. C. B. couplers, standard trucks and fittings, steam brake, all steel gears; can be fitted with either a bottom-block, any kind of bucket, shovel attachment, magnet or piledriver, all interchangeable in a short time; easily operated; fitted with steam or electric power or with an internal combustion engine.

### BUCKETS:

Grab buckets, two and single rope; drag line buckets; contractors' clam shell buckets; slag buckets; and tubs. The designs of these buckets are such that they get a full load each time and are under the control of the operator at all times. The best of material is used throughout, giving strength and durability to the spades, bearings, and digging edges.

### TRAMRAIL SYSTEMS:

These systems handle all the material overhead, reaching every floor in each building and as much yard space as

desired. We install the systems complete, using the well-known Brownhoist trolleys, which are recognized as the standard trolleys. Operated by electric or hand power.

### OVERHEAD HAND TRAVELLING CRANES:

Furnished in various capacities and spans. Built for easy operation, safety and low headroom. They are easily and quickly erected. Prompt shipment can be made. Operated with hand hoist, air hoist, or electric hoist.

### FREIGHT HANDLING EQUIPMENT:

This includes several different machines designed for handling the freight at a much reduced cost over the present methods. The freight is handled overhead from car to sorting platform, warehouse, wagon or other cars. It requires just a few men, eliminates confusion and costly mistakes, and increases the terminal capacity.

### CONCRETE REINFORCEMENT:

Ferroidinclave is a patented corrugated sheet steel used as a reinforcement for concrete. It requires no forms during erection, and is easily laid by the workmen. It is used for concrete roofs, floors, bins, walls, partitions, silos, bridges, stairs, etc.

We also make power scraper shovels, work-car cranes, jib cranes, pillar cranes, bridge cranes, crabs, winches, transfer tables and water-closet shields.

Catalogs and prices furnished on request.

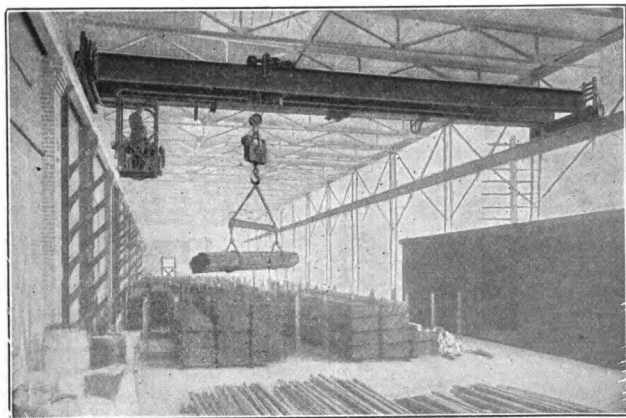




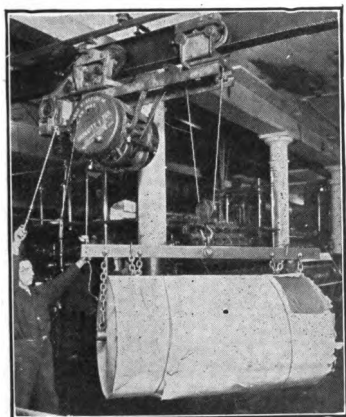
## NEW JERSEY FOUNDRY & MACH. CO.

88 WEST ST., NEW YORK

Manufacturers of Overhead Carrying Devices



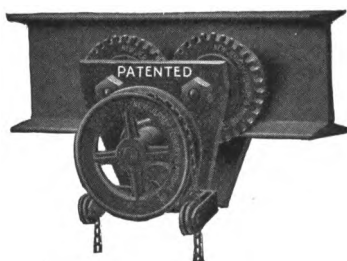
### HAND AND ELECTRIC TRAVELING CRANES, TROLLEYS, HOISTS AND MONORAIL EQUIPMENT:



Our Catalog 88 contains detailed information on our line of Overhead Carrying Devices, Tracking, Trolleys, Hoists, Cranes, Buckets, Cars, etc. Two representative installations are shown above. Many others illustrated in catalog. A copy will be promptly sent on request.

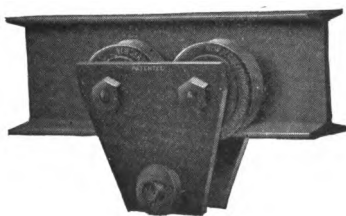
#### **"Changeezy" I-Beam Trolley (Patented):**

Can be used both plain and geared.



367

Made with steel side plates and adjustable to three sizes of beam standard.



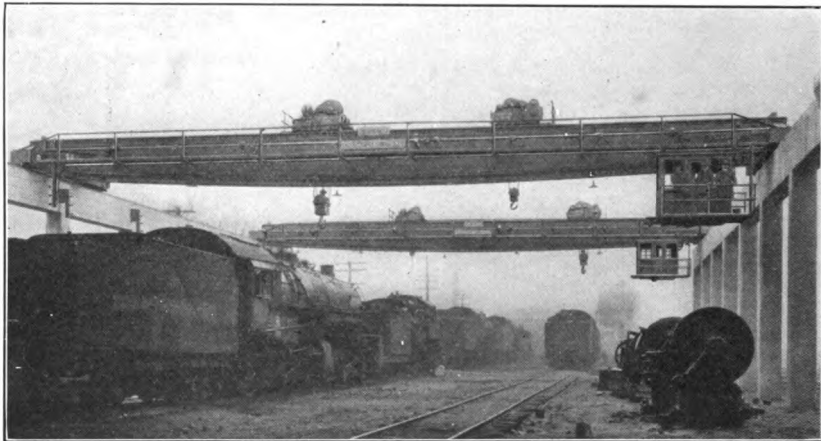
#### **"Delta" I-Beam Trolley (Patented):**

The wheels of both Changeezy and Delta trolleys are inclined to run true on lower flanges of the beam, the axle connection swivels, equalizing the load on all wheels, and the load force lines radiate from the inside of the hoist link.

## CHESAPEAKE IRON WORKS

BALTIMORE, MD., U. S. A.

Manufacturers of Electric Cranes; Steel and Iron Work



2 25-Ton Electric Traveling Cranes with 5-Ton Auxiliary Trolleys  
85'-0" Span. B. & O. R. R., Baltimore, Md.

### 368 STEEL CONSTRUCTION:

The Chesapeake Iron Works will undertake contracts for the manufacture of any number of steel buildings or similar structures of all sizes. In so doing, we contract to: (1) furnish the steel, (2) ship the fabricated pieces for the purchaser to erect himself; (3) or else we undertake the complete design and erection of the building. Detailed information or estimates on request.

#### THE CHESAPEAKE CRANE:

By a careful study of crane requirements we have incorporated in the Chesapeake Crane all of the essentials of a rugged heavy duty crane. It reduces labor, allows full use of every foot of floor space to advantage, and handles larger and heavier loads than could formerly be handled. The wearing surfaces are made large in order to insure long life and low cost of maintenance. To withstand the strains caused by too rapid acceleration or vicious application of the foot brake when running at full speed, the Chesapeake crane has been constructed ruggedly in every part.

#### DETAILS OF CONSTRUCTION:

**Bridge:** Girders for cranes of moderate size are of braced I-beam construction, proved by experience the most efficient. For cranes of heavier capacity or larger span, the girders are of the box section type. The cover plates and chord angles

are full length (no splice). Stiffener angles of full depth of web are employed liberally. All holes are laid out to templet, reamed and no drifting being allowed.

The bridge drive consists of a centrally located motor which transmits power through a heavy cross shaft supported in babbitted cap bearings. Truck wheels are of chilled cast iron, ground to true diameter and bronze bushed. They revolve on heavy fixed axles and have for characteristics extreme accessibility and self-alignment after removal for repairs.

**Trolleys:** Are built to meet the most exacting demands that can be made on cranes.

The frame is of heavy section and supports the drive mechanism rigidly, allowing no distortion. The two-motor direct-current type trolley is built for operation by direct current motors only. The lowering of the load is controlled by a dynamic braking system, with the addition of a powerful electric brake applied to the motor to hold the load when the current is off.

The two-motor trolley with load brake is suitable for either direct or alternating current motors. The hoist is equipped with a powerful double disc Chesapeake Mechanical Load Brake which positively controls the load and prevents it from being lowered except by the hoist motor.

## CHESAPEAKE IRON WORKS

In addition, the hoist motor is equipped with a Chesapeake iron clad, solenoid band type, electric brake of sufficient power to hold the full load without use of the load brake.

All gears and pinions are cut from solid steel. The bearings are bronze bushed and supplied with grease lubrication; the gears fully enclosed or suitably guarded. Through bolts with "Grip" nuts are used all over the mechanism.

**Solenoid Brake:** This has a holding power equally effective in either direction. It is used to stop the hook when hoisting at high speed, or to hold the load when current is off. The band is of special steel, lined with special brake lining. The brake wheel is polished and hardened. Only one adjustment is necessary, parts are extra strong, and very little attention or replacement is required.

**Mechanical Load Brake:** Is of the double disc type, is positive in action and has ample capacity to sustain full load without use of the electric brake. It allows load to descend only when operated by the hoist motor. The brake and gears are enclosed in an oil-proof case, and form a self-contained unit, simple in design and heavy in all its details. The steel ratchet is machined from solid steel; discs are self-lubricating bronze. Adjustment is made by moving one nut which is reached by taking off one bearing cap, and which is securely locked when cap is replaced.

**Bottom Block:** The Chesapeake Bottom Block is built of heavy structural steel, with bronze bushed sheaves machined to suit the hoisting rope. The heavy steel shaft lubricated through grease receptacles machined in shaft. The hook, of forged steel, revolves on high grade ball bearings.

**Foot Brakes:** The bridge is equipped with a powerful foot brake band type, having one adjustment which can skid the truck wheels when the crane is under full load. The lining is renewable and engages almost the entire circumference of the brake wheel. The foot pedal is located in the operator's cage.

**Cable Drum:** This can be attached at any time to any Chesapeake Crane. Its purpose is properly to take care of the magnet cable on cranes equipped with magnets or motor operated grab buckets.

**Safety-First Features:** Many of these details are furnished only on Chesapeake Cranes; switchboard, mounted in a steel cabinet with steel door and lock. It includes a double pole main switch, a contactor, a safety plug, and independent overload relays for each direct current motor.

Limit switch, which prevents over-hoisting, is operated by hook block in conjunction with no-voltage contactor on switchboard. The push button for re-set is in front of operator.

All gears are enclosed or suitably protected.

Bumper blocks are placed on bridge ends.

Rail sweeps are provided on bridge ends.

All parts are easily accessible to inspection and are easily removed for repairs.

**The Operator's Cage and Switchboard:** Has been carefully designed to give most convenient operation.

The cage is of heavy steel angles, well braced.

The switchboards are mounted in steel cabinets with steel doors and lock. Push buttons are conveniently located in front of operator; one for closing the contactor and one for resetting it when tripped by action of the hoist limit switch. 369

The bridge foot brake is supplied with heavy springs which prevent contact of brake band and drum except when the brake is in use.

### CRANES FOR EXPORT:

In order to reduce the cost of tariff on cranes built for export, we can, when desired, make certain changes and omissions, which, while not reducing the operating efficiency of the crane, will considerably lower the cost.

These changes would consist of the following:

Omitting gear cover and guards, bumper blocks, rail sweeps, and the wood flooring of girder platform.

Equipping the switchboard only with one main switch, and providing fuses for each motor.

Furnishing a type of limit switch that requires manual resetting.

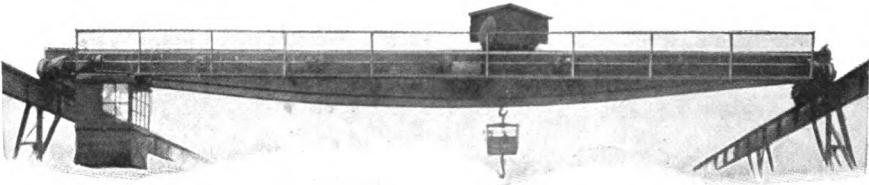
Supplying Load Brakes that are not enclosed.

Making Bottom Blocks for the smaller sizes out of steel castings.

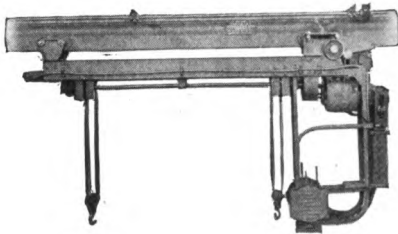
## NORTHERN ENGINEERING WORKS

DETROIT, MICH.

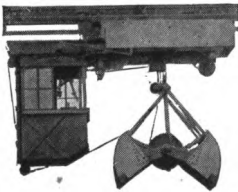
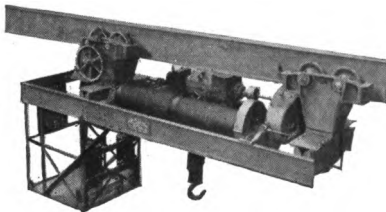
Manufacturer of Electric Traveling Cranes, Electric and Hand Cranes of All Types,  
Hoists and Machinery



ELECTRIC CRANES AND HOISTS



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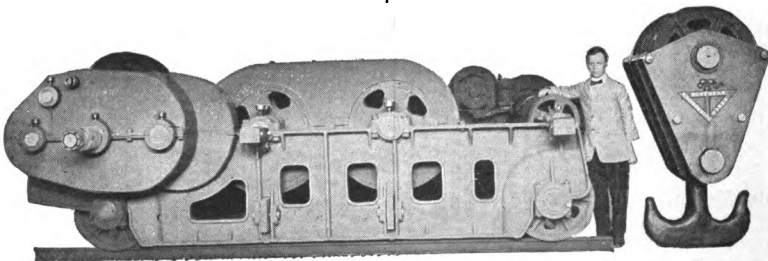


### NORTHERN CRANES

Northern Crane Products have been in use for nearly twenty years—**Northern Hoists** for nearly as long. In purchasing Northern Cranes or Hoists the buyer has behind his purchase an established firm of experience and responsibility. The designs have been kept up-to-date in both safety and convenience features.

Good service is assured every purchaser.

Catalogs and Bulletins free on request.



Northern Special Type E-100 Ton Trolley

# READING CHAIN AND BLOCK CORP'N

READING CHAIN BLOCK CO.

OPERATING

PENN CHAIN WORKS

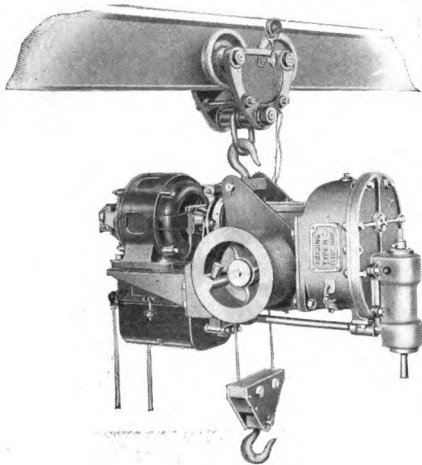
READING, PA.

EXPORT OFFICE: 17 BATTERY PLACE, N. Y.

TRADE **READING** MARK  
PRODUCTS

## ELECTRIC HOISTS:

$\frac{1}{2}$  to 10 ton.

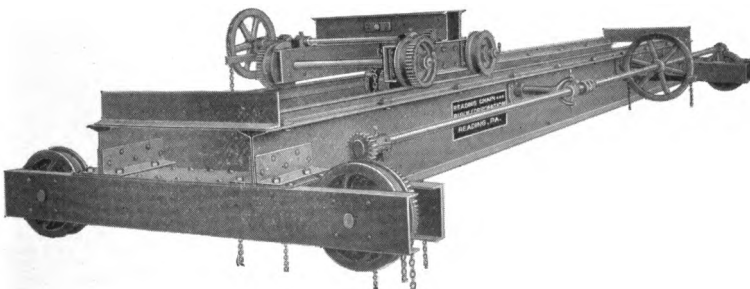


Direct or Alternating Current

## TRAVELING CRANES:

Hand or Electric.

1 to 20 tons.



## CHAIN HOISTS:

(Reading Multiple Gear.)

$\frac{1}{4}$  to 20 tons.

SAFETY

DURABILITY

EFFICIENCY



GEARS

RUN

IN

OIL

Steel from Hook to Hook

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## TROLLEYS

## ELECTRIC MONRAIL HOISTS

## SHEPARD ELECTRIC CRANE & HOIST COMPANY

NEW YORK  
PHILADELPHIA  
PITTSBURGH  
CHICAGO  
BOSTON

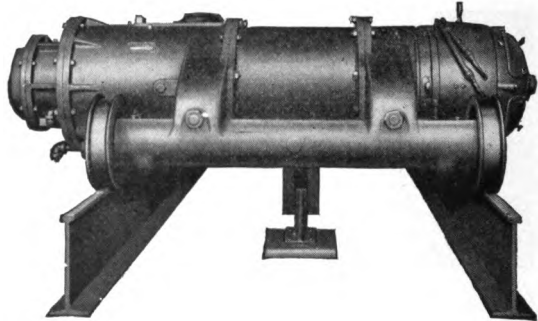
MAIN OFFICE & WORKS  
MONTOUR FALLS, N. Y.

BALTIMORE  
SAN FRANCISCO  
CLEVELAND  
MONTREAL  
LONDON, ENGLAND  
MELBOURNE, AUSTRALIA

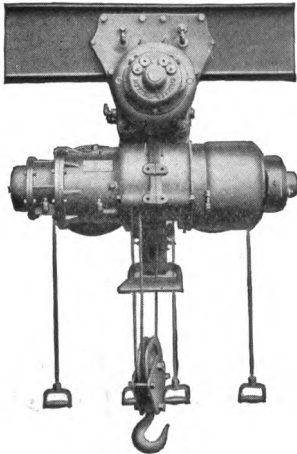
Direct and Alternating Cranes and Hoists for Every Service

### THE SHEPARD LINE IS COMPLETE:

SHEPARD Cranes and Hoists are handling materials in ninety varied industries. The selection and extension of this equipment has been largely governed by the evident superiority of the design and the new standard of reliability in service which it has established.



372 *SHEPARD Handbook—describing the complete line—will be sent on request. Write for it Now.*

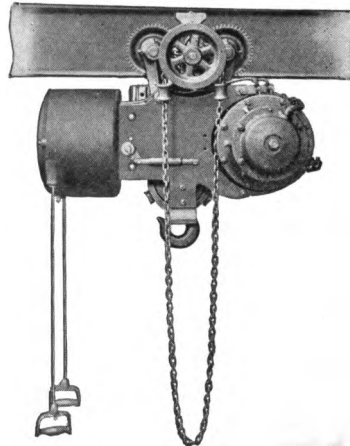


Foundry Control, D. C. Hoist with Motor Driven Trolley. Especially useful where loads must be carried distances too long for the workmen to push them on the runway efficiently.

The Sterling qualities of the Shepard Crane Trolley are secured by locating steel gearing and multiple discs within rigid cylindrical frames completely protected and completely protecting workmen.



HOIST?  
BUY A  
SHEPARD

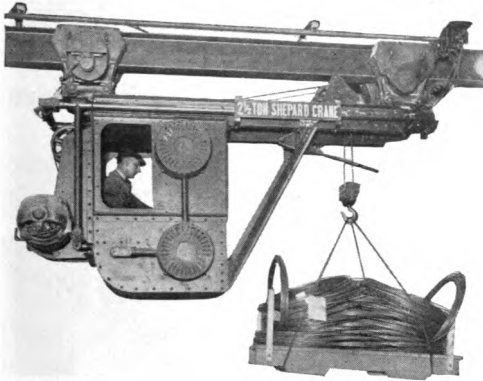


The use of this type of hoist permits hoist service in low headroom where sufficient lift could not be otherwise obtained.

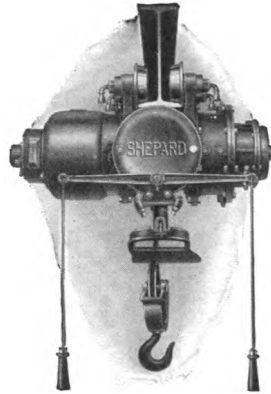
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## SHEPARD ELECTRIC CRANE & HOIST COMPANY

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Where groups of small units in trays are to be handled, this type of hoist has decided advantages, particularly where there are curves in the I-beam runway. It can be supplied with two load hooks where long flexible loads are to be handled.

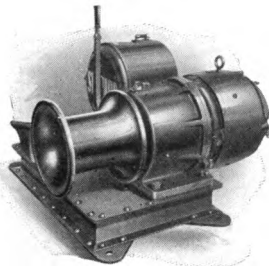


Our New Light Capacity Hoist, for handling of loads just too heavy for one man.

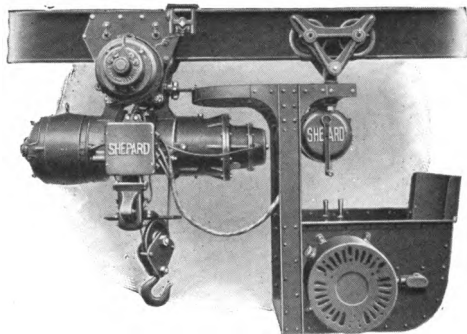
373



The Shepard Idea of Providing Complete Protection and Automatic Lubrication is Carried Throughout Shepard Cranes.



A compact, weather-proof winch with running parts completely enclosed and protected from all atmospheric conditions. Its uses are manifold in and about industrial plants.



The use of heavy duty Monorail Hoists with the flexibility of handling arrangements which transfer switches permit, revolutionizes handling methods in many industries. Can be enclosed for outdoor service.

## THE COBURN TROLLEY TRACK MANUFACTURING CO.

HOLYOKE, MASS.

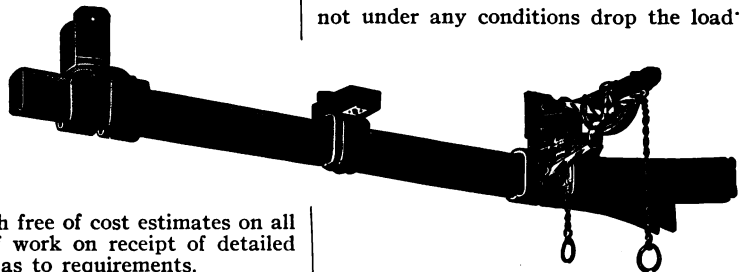
**Manufacturers of Overhead Tramrails, Traveling Cranes, Electric and Pneumatic Hoists, Door Hangers, Fire Shutters, Fire Escapes, Etc.**

### COBURN OVERHEAD CONVEYING SYSTEM:

The users of Coburn Overhead Conveying systems are so various that it is quite impossible to enumerate them all—They can be used anywhere that heavy material has to be handled—Coal to the boiler room—Ashes and cinders to the dump head—Iron in foundry and machine shops—etc.,—etc.

Besides the enclosed type of track, we manufacture a complete line of Overhead I-Beam track, carriers, switches, etc.

374



We furnish free of cost estimates on all this class of work on receipt of detailed information as to requirements.

*Our No. 50 catalogue is free for the asking.*

### SWINGING PENDANT DOUBLE CARRIERS:

A typical Coburn Carrier which can be equipped with either roller or ball



bearings, and so constructed as to move around the smallest curves with the greatest ease.

### REGULAR TONGUE SWITCH:

No matter how complicated your system may be, we can make satisfactory arrangements for the switches—Our switches are absolutely safe—They cannot under any conditions drop the load.

Regular Tongue Switch



---

## PHILADELPHIA TRAMRAIL COMPANY

FRONT STREET AND INDIANA AVE., PHILADELPHIA, PA.

**Manufacturers and Designers of Overhead Trolley Systems, Switches, Trolleys, and all Kinds of Overhead Trolley Equipment**

---



375

**Overhead Trolley System in Grinding Room**

Estimates furnished for installing overhead trolley systems for conveying all kinds of material: for Abattoirs, Canning Factories, Cold Storage Rooms, Factories, Foundries, Machine Shops, Markets,

Mills, Packing Houses, Printing Press Rooms, Smoke Houses, Warehouses, etc.

We also install Overhead Track Scales.

*Catalog on application.*

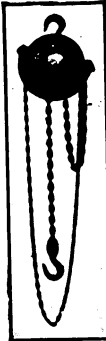
# FORD CHAIN BLOCK & MFG. CO.

SECOND AND DIAMOND STS., PHILADELPHIA, PA.

Manufacturers of the Ford Tribloc Chain Hoist, Screw Gear Hoists, Differential Hoists and Plain and Geared Trolleys

## THE FORD TRIBLOC CHAIN HOIST:

The Ford Tribloc Chain Hoist is built in sizes from one-half to forty tons capacity. It is equipped with the patented Loop Hand-Chain Guide which protects the working parts, keeps the chain from gagging, and enables you to operate at any angle and at any speed you may wish. It has steel working parts, planetary gearing (which is enclosed in a dust-proof steel case), and a  $3\frac{1}{2}$ -to-1 factor of safety in its weakest part.



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Eighty per cent of the power applied to the hand-chain of the Tribloc is converted into lifting energy.

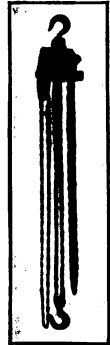
## ROLLER BEARING STEEL PLATE TROLLEYS:

We carry in stock, ready for immediate shipment, a line of Roller Bearing Steel Plate I-Beam Trolleys in a wide range of sizes, and in both the plain and geared types. Trolleys can be widened to suit larger than standard beams.

## SCREW HOISTS:

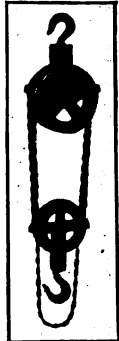
(Duplex Type)

For work where the highest speed and efficiency are not required, we can furnish the Ford Duplex Type Worm Gear Hoist. This type of hoist is frequently preferred for portable use, as it is lighter in weight and at the same time powerful and durable.



## DIFFERENTIAL HOISTS:

This is the simplest of all chain hoists, and where a hoist is required but occasionally and high efficiency and speed are not essential, it serves the purpose admirably. The Ford Differential Hoist is made with exceeding care and of the best material obtainable.



Send for a copy of our catalogue. It gives prices and goes into details.

## PRICE LIST—TRIBLOC CHAIN HOISTS

Capacity in Tons	Price Complete	Regular Hoist in Feet	Extra Hoist Price per Foot	Net Weight in Pounds	Feet of Chain Handled to Lift Load One Foot
$\frac{1}{2}$	\$35.00	8	\$0.90	53	21
1	45.00	8	0.95	80	31
$1\frac{1}{2}$	60.00	8	1.00	124	35
2	70.00	9	1.05	188	42
3	90.00	10	1.50	200	69
4	110.00	10	1.60	290	84
5	140.00	12	2.15	380	126
6	165.00	12	2.15	390	126
8	200.00	12	2.70	470	168
10	240.00	12	3.25	570	210
12	300.00	12	4.30	800	126*
16	360.00	12	5.40	1000	168*
20	425.00	12	6.50	1375	210*
32 }					
40 }					

Prices and full particulars upon request. \*For Each Hand Chain.

# AMERICAN HOIST & DERRICK CO.

WORKS AND EXECUTIVE OFFICES  
ST. PAUL, U. S. A.

BRANCHES  
CHICAGO, 713 Fisher Bldg.  
NEW ORLEANS, 410 Camp St.

SEATTLE, Washington

BRANCHES  
NEW YORK, 50 Church St.  
PITTSBURGH, 2119 Farmers Bank Bldg.

Manufacturers of Steam Engine Hoists, Steel Storage Cranes, Locomotive Cranes, Derricks, Electric Hoists, Wire Rope Clips, Blocks, Etc.

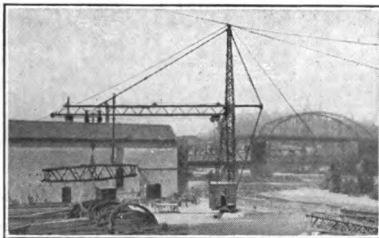
## "AMERICAN" STEAM HOISTING ENGINES:



"AMERICAN" Hoisting Engines are adapted to every kind of hoisting work. Single, double and triple friction drum types. Safety pawls hold any load hoisting or at rest. Boilers develop ample steam and are quick steamers. 7 x 10 engines and larger have friction and ratchet ring at operator's end, brake of similar diameter at opposite end of drums.

Brake and friction being separated, both work cool. Independent winch heads, engine parts wholly outside drums frames, everything accessible. Slewing attachments or separate slewing engines.

## "AMERICAN" STEEL STORAGE CRANES:



Well suited for storage yards handling lumber, steel, iron pipes, tile, stones or cane. Can be equipped with clam-shell buckets, cane grapples, etc. High horizontal boom permits storage close to foot of mast.

## GENUINE "CROSBY" WIRE ROPE CLIPS:



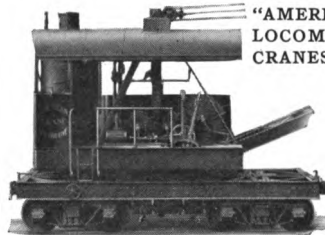
Drop-forged steel — high steel wings—broad grooved base—galvanized. Most dependable wire rope clip on the market.

## "AMERICAN" BLOCKS:



Plain, Marine (Wire Rope or Manila Rope) or Snatch Blocks. All have extra large pins and axles. Extra large amount of material in hooks and shackles. Special Blocks made to order.

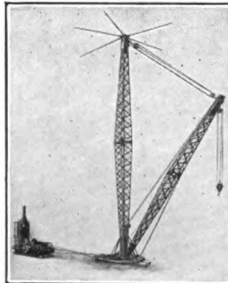
## "AMERICAN" LOCOMOTIVE CRANES:



Single-Piece gun-iron racer or revolving deck-non-reversing horizontal double-cylinder hoisting engine. Boiler with hot pressed extra-heavy rivets. Highest grade fittings. Steel canopy cab. Friction clutches insure smooth operation. Simple lever system. Low center of gravity.

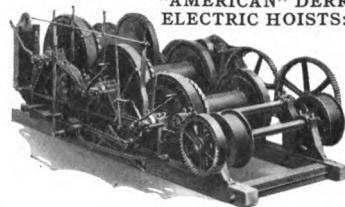
## "AMERICAN" DERRICKS:

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The "AMERICAN" Derrick line comprises Steel Guy Derricks (with Bull Wheel), Stiff-Leg Derricks, Erector's Guy Derricks, Guy Derricks (for clam-shell or orange-peel bucket work) and Barge Derricks. Detailed information will be sent upon request.

## "AMERICAN" DERRICK ELECTRIC HOISTS:



Designed to meet all requirements, can be supplied with from 1 to 3 drums and with slewing attachment and winch head. Illustration shows 3-drum type with slewing attachment for clam-shell derrick from frictions. Brakes on opposite ends of drums from frictions. Automatic Roller Ratchet Brake on motor counter-shaft is provided to prevent accident if current is suddenly cut off.

Owing to the brief space, no attempt for detailed descriptions has been made, but a brief suggestion of our line only. Complete information upon request.

## **CLYDE IRON WORKS**

29TH AVENUE WEST, AND MICHIGAN ST., DULUTH, MINN.

**Manufacturers of Hoisting Engines, Derricks and Derrick Fittings, Electric Hoists, Belt-Driven Hoists, Automatic Buckets**

### **HOISTING ENGINES AND BOILERS OF CLYDE-GRADE:**

Our product is used for all kinds of Contractor's work, Dredging, Pile Driving, Railroad and Bridge Building, Quarries and general hoisting purposes. We also make a specialty of engines for skidding and loading logs, and for general logging operations.

All our engines are thoroughly tested under steam as well as by the usual hydrostatic test. All parts are made from standard jigs and templates and are absolutely interchangeable.

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### **ONE, TWO, THREE, AND FOUR DRUM HOISTING ENGINES:**

In our 235-page catalog we illustrate the 2099 types and sizes of our standard engines with single or multiple drums, and single or double cylinders. These hoisting engines are regularly built with or without boiler, winch and sheave heads, and reversing gear. Clyde hoists of 7 x 10 and larger are built with all-steel gears.

### **DERRICKS AND DERRICK FIT- TINGS:**

In this large catalog we also illustrate and list a complete line of timber derricks and fittings. Bulletin "N" contains our new line of All-Steel Derricks. All usual conditions can be met with some

one of our standard styles, but we are prepared to build derricks for any special conditions that may arise. For this purpose we maintain a force of draftsmen and engineers who are specialists in this line, and their experience of many years is at the disposal of our customers.

Clyde Derricks are designed with great care to withstand violent strains. Every possible point of weakness, both in the fittings and in their action on the timbers, has been guarded against and we claim our fittings to be the strongest on the market for the size of timbers for which they are intended.

Following is a partial list of our standard styles of derricks:

Standard Guy Derricks  
Half Hand Power Guy Derricks  
Hand Power Guy Derricks  
Clam Shell Guy Derricks  
Standard Stiff Leg Derricks  
Half Hand Power Stiff Leg Derricks  
Hand Power Stiff Leg Derricks  
Clam Shell Stiff Leg Derricks  
Full Circle Stiff Leg Derricks  
Self-Propelling Derrick Cars  
Self-Contained Portable Derricks  
All-Steel Derricks

We also manufacture a complete line of logging machinery, of land-clearing machinery and of excavating machinery, including the CLYDE TOWER EXCAVATOR for levee building and drainage-canal digging.



## S. FLORY MANUFACTURING CO.

MAIN OFFICE: BANGOR, PENNA.

NEW YORK OFFICE: 95 LIBERTY ST.

### ELECTRIC

### STEAM

"FLORY:" The Name That Eliminates Doubt

Specialists In

#### MINING HOISTS:

Made in all sizes and types for any mining service.

Cone or Band Friction (Werner Patent Band Friction), gives absolute control and eliminates all stress in drum shaft.

#### MARINE AUXILIARIES:

Steering Engines, Windlasses, Winches, Capstans, Dock Hoists, Marine Railway Engines, Dredging Machinery, Spud Hoists, Cleats, etc.

#### CONTRACTORS' EQUIPMENT:

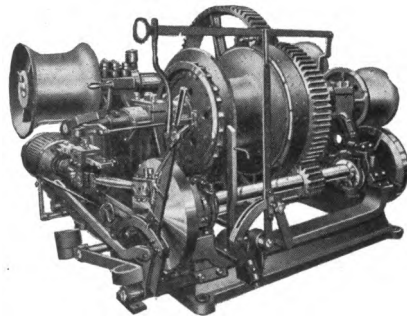
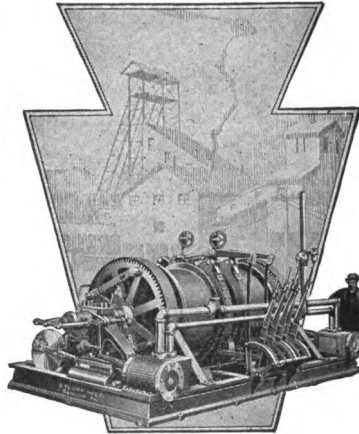
Derrick Hoists and Fittings, Drag Line Engines, Boom Swingers, etc.

#### CABLEWAYS:

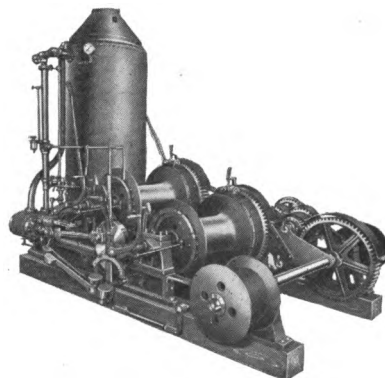
For Bridge and Dam Building, Removing Top, Conveying Material, Sewer Building, etc.

OUR ENGINEERS are fully competent to figure with you, on your requirements, by reason of years of experience.

*Catalogues Free.*



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## **ROBT. HOLMES & BROS.**

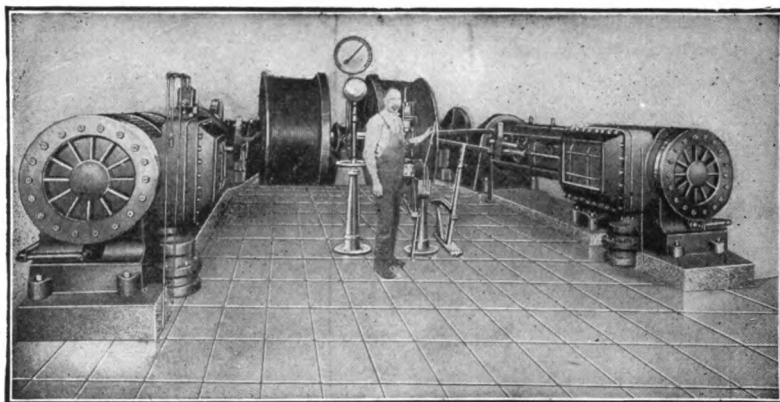
(Incorporated)

Successors to Danville Foundry and Machine Co.

DANVILLE, ILLINOIS, U. S. A.

**Engineers, Founders, Machinists and Boilermakers**

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### **380 BUILDERS OF:**

**HOISTING AND HAULAGE  
ENGINES.**

**SHAKER SCREENS AND WEIGH  
HOPPERS.**

**SELF-DUMPING CAGES AND  
EMPTY CAR LIFTS.**

**MILL AND MINE SUPPLIES.**

**Danville Hoisting and Haulage En-  
gines, Both Light and Heavy Duty Type,  
First and Second Motion.**

**Halbert's Patent Self-Dumping Cages.**

**Ray's Patent Self-Dumping Cage.**

**Plain Cages.**

**Holmes' Shaker Screen.**

**Sheave Wheels for Hoisting and  
Haulage.**

**Holmes' Telescoping End Loader.**

**Holmes' Patent Weigh Hopper.**

**Holmes' Automatic Car Lifts for Mine  
Bottoms.**

**Iron, Bronze and Brass Castings of All  
Description.**

**Heavy Iron and Steel Forgings.**

*All Kinds of Plate Metal Work, Particu-  
larly for Coal Mines.*

# LIDGERWOOD MANUFACTURING CO.

MAIN OFFICES

96 LIBERTY ST., NEW YORK

CHICAGO, Fisher Building  
SEATTLE, 65 Columbia Street

BRANCH OFFICES:

LONDON, ENGLAND

PITTSBURGH, Union Bank Building  
PHILADELPHIA, Widener Building  
LOS ANGELES, Central Bldg.

**Manufacturers of Steam Hoisting Engines, Electric Hoists, Gasoline Hoists, Derricks, Cableways, Dredging and Excavating Machinery, Mine Hoists, Logging Machinery, Ship and Dock Winches, Steering Engines, Towing Engines**

## FOREWORD:

The Lidgerwood hoisting machinery of today embodies every improvement in design and construction developed by our 46 years' experience.

We design the complete machine to operate under the maximum service it is to perform, and build every part to meet the full working capacity of the machine.

Every part is accurately constructed upon the duplicate part system, insuring the absolute fitting of repair parts.

We have kept pace with the development of electrical engineering, and can supply our electric hoists equipped with the latest automatic control and safety devices, and type of motor best adapted for the work to be done by the hoist.

Our friction drum hoists have cork inserted friction woods. This increases the holding power of the friction and greatly reduces the power required to apply the friction. The entire friction mechanism is extremely simple.

**STEAM, ELECTRIC AND GASOLINE HOISTS** for all kinds of derrick service, including grab bucket work.

**STEEL DERRICKS** of all types; derrick fittings for wooden derricks.

**PILE DRIVING HOISTS**, pile driving frames and hammers.

**HIGH SPEED BUILDERS' HOISTS** for operating material and hod elevators.

**STEAM AND ELECTRIC HOISTS** designed for shaft and tunnel work, bridge erection and to meet every requirement of contracting work.

**DREDGING AND EXCAVATING MACHINERY.** Steam and electric bucket and swinging engines for operating both grab and scraper buckets on land and water outfits, both for dredging and for loading and unloading sand, gravel and coal barges.

Spud engines and cutter engines for suction dredges, built with special regard to the severe duty such machines perform.

**STRAIGHT LINE CABLEWAY EXCAVATORS**, steam or electric driven, with traveling towers, built in spans to meet service required. Operate drag scraper, or grab buckets. The high conveying speed enables them to excavate material rapidly and economically over wider areas than it is practicable to reach with the revolving type of excavator. Have handled 55 trips per hour, over a reach of 500 feet, using a three cubic yard scraper bucket.

**CABLEWAYS:** Lidgerwood cableways, steam or electrically driven to handle loads of from one to fifty tons, with spans up to 3,000 feet and with stationary or traveling towers. A prominent feature is the high speed fall rope carrier.

**MINE HOISTS** for every character of incline haulage and mine shaft service. Steam hoists built up to 1000 H. P. and electric in any size, and fitted with complete control and safety appliances.

**LOG HANDLING SYSTEMS:** High speed ground and overhead log skidding systems.

**RAPID UNLOADERS** for unloading ballast cars.

**CAR HAUL HOISTS.**

**INCLINE COAL HOISTS.**

**COAL TOWER BUCKET AND TROLLEY HOISTS.**

**SHIPS CARGO AND DOCK WINCHES.** Steam and electric; a type designed for each method of cargo handling.

**STEERING ENGINES**, of all types.

**TOWING ENGINES.** Maintain a constant stress on hauler.

*Catalogs upon request. Engineering staff at your service.*



## INDUSTRIAL WORKS

BAY CITY, MICH.

BRANCH OFFICES: 50 Church St., New York, Widener Bldg., PHILADELPHIA, McCormick Bldg., CHICAGO and Book Bldg., DETROIT.

**Builders of Locomotive, Erection and Wrecking Cranes; Gasoline Coaling Cranes; Pillar Cranes; Transfer Cranes; Pile Drivers; Transfer Tables; Portable Rail Saws; Grab Buckets; Lifting Magnets; and Pile Driver Steam Hammers**

AGENTS: C. B. Davis Engineering Co., Birmingham, Ala.; J. G. Miller, St. Louis, Mo.; F. H. Hopkins & Co., Montreal, Que., and Toronto, Ont.; Northwestern Equipment Co., Portland, Ore., and Seattle, Wash.; N. B. Livermore & Co., San Francisco, Cal.

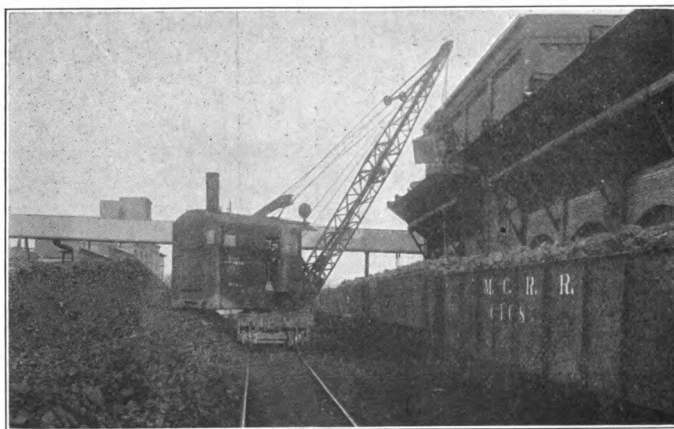
**INDUSTRIAL WORKS** was founded in 1873 and Industrial Works Cranes of today are the development of over forty-six years' experience. Satisfactory service under widely varied conditions of service has proved that they are fundamentally correct in design, sturdy in construction and efficient in operation. In size they range from 2-ton hand operated cranes to wrecking cranes of 160 tons capacity.

### LOCOMOTIVE CRANES:

382 Industrial Works Cranes, steam, gasoline or electrically operated, are made in capacities of from 5 to 160 tons, and with booms from 20 to 125 ft. long. They are

buckets, hook and block, lifting magnets, or arranged for operating with a drag-line bucket, pile-driver leads or a steam-shovel dipper arm.

Mechanically, Industrial Works Cranes are not excelled. Every essential part of the entire crane is made, assembled and tested in our own extensive shops. All parts of the crane are accessible for easy examination, a large man being able to pass through the machinery part and car to the ground. Absolute interchangeability of parts is assured by the use of jigs and templates at every possible point in the construction. Inconvenient bearings are lubricated through oil pipes. The propelling gears on 8-wheel cars are placed in or out of mesh from the outside of the



**A Flexible System.**  
Coal may be handled with the crane:

1, from cars to bunkers; 2, from cars to stock pile; 3, from stock pile to bunkers

mounted on four- or eight-wheel cars for standard or special gauge track, or on boats and gantries. Being self-propelling, they can switch several loaded cars. These cranes may be used with grab

car body. For clam-shell bucket work, both drums are independent and the auxiliary take-up drum for the holding line is automatic in its action, requiring no attention from the operator.

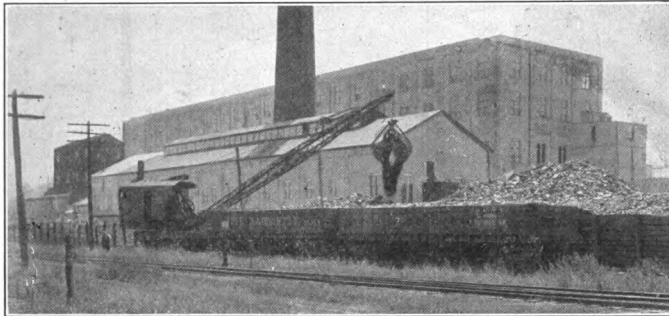


# INDUSTRIAL WORKS

**Data:**

In general all sizes of locomotive cranes do the same kind of work, the amounts being limited, of course, by their capacities. The 60-ton capacity cranes are

Locomotive cranes are usually rated according to their maximum free capacity at the minimum radius (about 12 ft.). The table gives the approximate radius in feet at which various size cranes will



Unloading  
Coal into  
Storage

used chiefly for erection purposes; those from 20 to 40 tons for erection work or for handling large quantities of material with a bucket or magnet; cranes from 5 to 20 tons are general purpose machines, and are in general use for all kinds of loading and placing of material.

	Size of Crane	Radius in feet with material as indicated	
		Coal	Sand
1½-Yd. Bucket...	5 ton	20	18
	12 ton	25-37	25-33
	15 ton	41-46	36-41
	20 ton	48-52	44-48
2-Yd. Bucket....	25 ton	49-52	37-41
	30 ton	52-54	42-46
	40 ton	58-61	47-51

handle clam-shell buckets full of coal and sand. (A 1½-cu. yd. bucket holds approximately one ton of coal.)

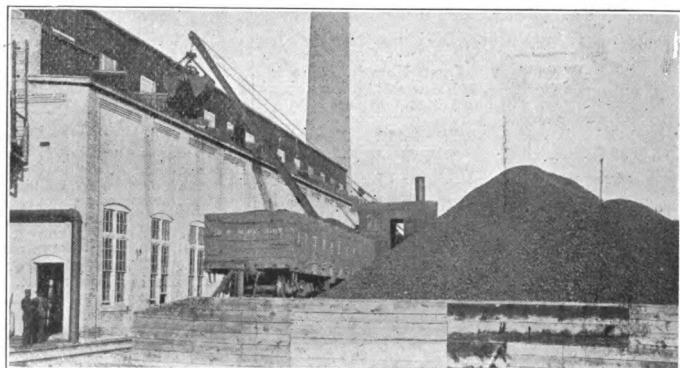
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To unload material with a grab bucket from the far end of a modern gondola car standing on the same track as the crane requires a 50-ft. boom. In general, the shorter the boom, the easier and faster will be the operation of the crane.

## WRECKING CRANES:

Industrial Works wrecking cranes have been standard since 1883. Built in capacities of 75, 100, 120, 150, and 160 tons.

Direct  
from Car  
to  
Overhead  
Bunkers



*Hoists, Turbines, Charging Machines, Producers, Conveying Machinery*

## THE WELLMAN-SEEVER-MORGAN CO.

CLEVELAND, OHIO, U. S. A.

Engineers and Manufacturers

WORKS: CLEVELAND AND AKRON, OHIO  
SAN FRANCISCO

BRANCH OFFICES: NEW YORK  
ATLANTA DENVER SEATTLE

PHILADELPHIA

### MINING MACHINERY:



Twelve Foot Double Drum Direct  
Action Mine Hoist

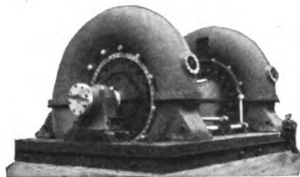
Hoists, Haulages and Gravity Incline Machines, Steam and Electric Driven, from 3 H. P. to 2000 H. P. in any combination of equipment for any service.

Cages, Skips, Safety Detaching Hooks and Sheaves.

Chilian Mills, Car Tipples, Dumping Cradles and Head Frames.

### WATER POWER EQUIPMENT:

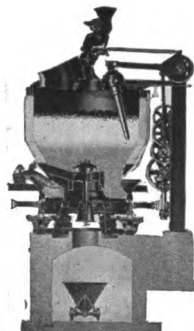
384



15000 Horse Power Turbine

Hydraulic Turbines, Vertical and Horizontal Settings for all heads up to 800 feet. Especially designed for High Efficiency.

### IRON AND STEEL WORKS EQUIPMENT:



Hughes Gas Producer

Open Hearth, Heating and Annealing Furnaces and Metal Mixers.

"W-S-M" Charging Machines and Manipulators. High and low floor and crane types. Open Hearth Charging Cars and Boxes.

"Hughes" Continuous Mechanically Poked Gas Producers and W-S-M Gas Shut-off Valves.



"W-S-M" Open Hearth Charging Machine

"W-S-M" Water-Sealed Reversing Gas Valves. Blooming Mills and Engines.

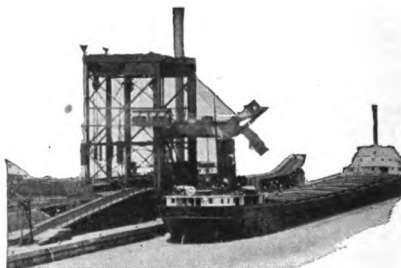
### COKE OVEN MACHINERY:



Combined Coke Pusher and Coal Leveler

Coal Levelers, Coke Pushers and Door Extractors, in separate or combined machines, Charging Cars, Quenchers and Loaders.

### ORE AND COAL HANDLING MACHINERY:



Boat Loading Coal Car Dumper

W-S-M Automatic Vessel Unloaders, Steam Electric and Hydraulic driven. Bridges for unloading and Stocking Ore, Coal and Limestone.

Buckets: Two part Clam-Shell.

Car Dumpers: Steam and electric driven. Revolving Derricks and Bucket Handling Cranes.

Also Rubber Machinery, Port and Terminal Equipment, Marine Equipment.

Catalogues or Bulletins, and prices furnished on request.



# MACOMBER & WHYTE ROPE CO.

HOME OFFICE AND WORKS  
KENOSHA, WISCONSIN  
BRANCHES AT

CHICAGO

PORTLAND

PITTSBURGH

Makers of Wire Rope of Every Description



## WIRE ROPE:

"Monarch Whyte Strand" is made from wire having a tensile strength of from 220,000 to 280,000 pounds per square inch—it is superior to any other wire rope made—it is uniform and dependable—the strongest, toughest and most durable rope obtainable—this is the best—but we make all grades—and all constructions—some are listed below.

### STANDARD HOISTING ROPE 6 Strands of 19 Wires Each—1 Hemp Center

Dia. of Rope	Weight per Foot, Lbs.	Monarch Whyte Strand		Plough Steel		Crucible Steel	
		L. P.	B. S.	L. P.	B. S.	L. P.	B. S.
1/4	.10	13	3 5	12	3	9	2
3/8	.22	14 1/2	6 7	12 1/2	6	9 1/2	5
1/2	.39	17	12	14	10	11	8
5/8	.62	22 1/2	19	19	16	14	12
3/4	.89	31	26	26	23	19	17
7/8	1.20	39	35	34	29	24	23
1	1.58	50	45	43	38	31	30
1 1/4	2.0	62	56	54	47	38	38
1 1/2	2.5	75	69	65	58	46	47
1 3/4	3.	90	84	79	72	56	56
1 7/8	3.5	110	98	93	82	66	64
2	4.15	130	110	108	94	77	72
2 1/4	4.85	160	133	130	112	90	85
2 1/2	5.5	175	150	146	127	102	96
2 3/4	6.3	185	166	158	140	116	106

L. P.=List Price per Foot in Cents

B. S.=Breaking Strength in Tons of 2000 lbs.

### HAULAGE ROPE 6 Strands of 7 Wires Each—1 Hemp Center

Dia. of Rope	Weight per Foot, Lbs.	Monarch Whyte Strand		Plough Steel		Crucible Steel	
		L. P.	B. S.	L. P.	B. S.	L. P.	B. S.
1/4	.15			6	4 1/2	4 1/2	3 1/2
3/8	.22	8 1/2	6 1/2	6 1/2	6	5 1/2	4 1/2
1/2	.30	11 1/2	7 1/2	9	7	6 1/2	5 1/2
5/8	.39	13 1/2	11	11 1/2	10	8	7 1/2
3/4	.50	17	13	14 1/2	12	10	10
7/8	.62	20 1/2	17 1/2	17 1/2	16	12	13
1	.89	28 1/2	25	24 1/2	23	17	18 1/2
1 1/4	1.20	37	33	32	31	22 1/2	24
1 1/2	1.58	48	42	41	38	29	31
1 3/4	2.0	58	52	51	47	36	37
1 7/8	2.5	72	67	62	60	43	46
2	3.	88	79	76	72	51	53
2 1/4	3.5	1.05	90	90	82	60	63

L. P.=List Price per Foot in Cents.

B. S.=Breaking Strength in Tons of 2000 lbs.



## KILINDO-PATENT NON-ROTATING ROPE:

We are the patent owners and makers of this non-spinning non-twisting wire rope—particularly adaptable in all cases where the load hangs on the free end of a hoisting line—is more flexible than ordinary rope—has 200% greater wearing surface.

385

Dia. of Rope	Weight per Foot, Lbs.	Monarch Whyte Strand		Plough Steel		Crucible Steel	
		L. P.	B. S.	L. P.	B. S.	L. P.	B. S.
3/8	.25	8 1/2	6 1/2	7 1/2	5 1/2	6	4 1/2
1/2	.43	10	12	9	10	7 1/2	8 1/2
5/8	.55	12	14 1/2	11	12	8	10
3/4	.67	14	19	13	15 1/2	9	12 1/2
7/8	.95	21	26	18	23	12	17 1/2
1	1.3	25	35	23	29	16	23
1 1/4	1.7	34	45	30	38	20	30
1 1/2	2.2	39	56	36	47	25	38
1 3/4	2.7	49	69	43	58	30	47
1 7/8	3.3	62	84	55	72	37	56
2	3.9	75	98	64	82	43	64
2 1/4	5.5	112	133	92	112	63	85
2 1/2	7	122	166	107	140	73	106
2 3/4	8	157	210	140	186	92	133
3	8.5	185	263	175	229	120	170

In ordering wire rope if you are uncertain as to the proper grade or construction, write to us for recommendations as to ropes best suited to your needs.

We also make hardware, fittings and auxiliaries used with rope.

Catalogue "M"—strictly up to date—sent on request.

## JOHN A. ROEBLING'S SONS COMPANY

TRENTON, N. J.

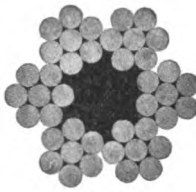
Manufacturers of Wire Rope of All Kinds

We manufacture and keep in stock at our works in Trenton and at warehouses, agencies and branches in large cities wire rope, made from Iron, Cast Steel, Extra Strong Cast Steel, Plough Steel and Blue Center Steel.

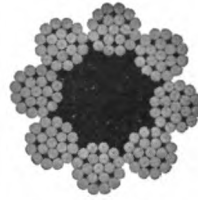
We give below tables of strengths, etc., for the standard constructions of BLUE CENTER STEEL ROPE. This rope is also furnished with 6 strands of 37 wires each and with 8 strands of 19 wires each.



6 x 19



6 x 7



8 x 19



6 x 37

Roebling Blue Center Steel Rope is recommended as the best to use where extreme conditions tend to bring extraordinarily severe stresses, and is particularly well adapted to resist abrasion.

The hemp center of this rope, where a hemp center is used, is colored blue to distinguish it from other grades.



## BLUE CENTER STEEL HOISTING ROPE

Composed of 6 Strands and a Hemp Center, 19 Wires to the Strand

386

Trade Number	Diameter in inches	Approx. circumf. in inches	Approx. weight per foot	Approx. strength in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheave in feet advised
00	2 3/4	8 5/8	11.95	315	63	11
0	2 1/2	7 7/8	9.85	262	53	10
1	2 1/4	7 1/8	8	210	42	9
2	2	6 3/4	6.30	166	33	8
2 1/2	1 7/8	5 3/4	5.55	150	30	8
3	1 3/4	5 1/2	4.85	133	27	7
4	1 1/2	5	4.15	110	22	6 1/2
5	1 1/4	4 3/4	3.55	98	20	6
5 1/2	1 3/8	4 1/4	3	84	17	5 1/2
6	1 1/4	4	2.45	69	14	5
7	1 1/8	3 1/2	2	56	11	4 1/2
8	1	3	1.58	45	9	4
9	7/8	2 3/4	1.20	35	7	3 1/2
10	3/4	2 1/4	.89	26.3	5.3	3
10 1/4	3/4	2	.62	19	3.8	2 1/2
10 1/2	5/8	1 3/4	.50	14.5	2.9	2 1/4
10 3/4	1/2	1 1/2	.39	12.1	2.4	2
10a	1/2	1 1/4	.30	9.4	1.9	1 3/4
10b	5/8	1 1/8	.22	6.75	1.35	1 1/2
10c	1/2	1	.15	4.50	.9	1 1/4
10d	3/4	3/4	.10	3.15	.63	1

## BLUE CENTER STEEL ROPE

For Haulages and Transmissions. 6 Strands and a Hemp Center, 7 Wires to the Strand

11	1 1/2	4 3/4	3.55	90	18	11
12	1 1/8	4 1/4	3	79	16	10
13	1 1/4	4	2.45	67	13	9
14	1 1/8	3 1/2	2	52	10	8
15	1	3	1.58	42	8.4	7
16	7/8	2 3/4	1.20	33	6.6	6
17	3/4	2 1/4	.89	25	5	5
18	3/4	2 1/8	.75	20	4	4 1/2
19	3/8	2	.62	17 1/2	3.5	4 1/2
20	3/8	1 3/4	.50	13	2.6	4
21	1/2	1 1/2	.39	11	2.2	3 1/2
22	1/2	1 1/4	.30	7 3/4	1.5	3
23	3/8	1 1/8	.22	6 1/2	1.3	2 1/2

A copy of our catalogue, giving information about other wire ropes and wire rope fittings, will be mailed on application.

# WRIGHT WIRE COMPANY

WORCESTER, MASS.

BRANCH OFFICES: BOSTON, NEW YORK, PHILADELPHIA, CHICAGO, TULSA, OKLA.,  
SAN FRANCISCO

Manufacturers of Wire, Wire Rope and Wire Products

## WIRE ROPE FOR ALL PURPOSES:



We combine the highest quality of material with the greatest degree of skill in the manufacture of all our Wire Rope products.

### Iron Ropes

Crucible Cast Steel Ropes

Plow Steel Ropes

Galvanized Ropes

Towing or Mooring Hawsers

Hoisting Ropes, Regular

Flexible, and Extra Flexible

Suspension Bridge Cables

Ropes for Tramways, and Cable  
for Transporting Coal, Ore, etc.

Ropes for Elevators, Power Transmis-  
sion, Mining and Logging

Standing and Running Rigging

Derricks and Dredges

Tiller Ropes

All Kinds of Wire Rope, Fittings  
and Appliances

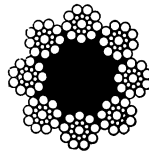
Ordinary forms and sizes always in stock. Special forms made to order promptly.

We furnish ropes of Swedish Iron, Crucible Cast Steel, Extra Strong Crucible Cast Steel, Plow Steel, Excelsior Plow Steel, Bronze or other material.

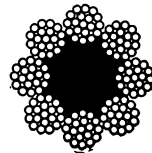
### EXTRA FLEXIBLE ROPES, IRON, CRUCIBLE AND PLOW STEEL:

We desire to call special attention to our **Extra Flexible Ropes**, of which we manufacture large quantities, and which have become very popular with users of wire ropes in various industries.

## 8 Strands, 19 Wires to the Strand



One  
Hemp  
Core



Our **Extra Flexible Ropes** are made of eight strands around a hemp core, instead of the standard form of six strands. They are thoroughly efficient and very strong, and because of their much greater flexibility can be used under many conditions in which the use of six-strand ropes would not be feasible. They are designed for running over comparatively small sheaves. 387

Recommended for derricks, steam dredges, electric cranes, coal-hoists, for logging purposes, and for elevator cables.

In many cases where regular six-strand hoisting ropes have failed to work economically, our **Extra Flexible Ropes** have given perfect satisfaction in points of strength, length of service and economy.

Special flexible ropes are also made with 37 wires to the strand.

Wherever more than ordinary flexibility in wire ropes is desired, or the use of small sheaves and pulleys is necessary, we heartily recommend our **Extra Flexible Ropes**, made of our special high-grade quality of crucible cast steel and plow steel, which are the very best materials possible to use in wire ropes.

# NEWHALL CHAIN FORGE & IRON CO.

90 WEST ST., NEW YORK

156 SECOND ST.  
SAN FRANCISCO

126 NORTH 10TH STREET  
PHILADELPHIA

Manufacturers of Welded Chains of Every Description



Fig. 320

"TRIDENT" LOADING CHAIN:

"WARWICK" DREDGE CHAIN:

TRADE MARK



Reg. U. S. Pat. Off.

STEAM SHOVEL AND DREDGE  
CHAINS, ALL SIZES.

SLING CHAINS, ALL STYLES:

388

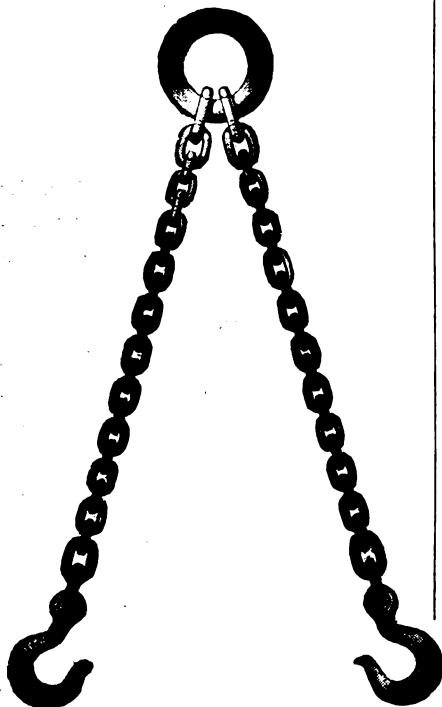


Fig. 355

## CHAINS FOR:

CARS	CRANES	CONVEYORS
DREDGES	ELEVATORS	HOISTS
LOGGING	MARINE RAILWAYS	MILL TRUCKS
POCKET WHEELS	QUARRIES	RAFTING
SPROCKETS	STEAM SHOVELS	ETC.

## OTHER PRODUCTS:

DROP FORGINGS	HAND FORGINGS	CHAIN HOISTS
CHOCKS	CLEATS	CLEVICES
COLD SHUTS	COMBINATION DRILL PRESS	
GUY CLAMPS	HOOKS	REPAIR LINKS
SHACKLES	SWIVELS	WIRE ROPE CLIPS

Write for Catalogue.

**CATALOGUE SECTION  
PART V**

**Metals, Alloys and  
Other Materials**

**389**

**Pages 391-414**





# BOUND BROOK OIL-LESS BEARING CO.

BOUND BROOK, NEW JERSEY

Specialists in the Manufacture of Oil-less Bushings for more than a Third of a Century

## A SAFEGUARD AGAINST NEGLECTED LUBRICATION:

There are many bearing points on motor car, truck and tractor chasses and on factory and textile machinery, and machinery in general, where the inaccessibility of the grease cups almost invariably invites neglect.

This has been the most frequent cause of premature wear and breakdown, and has resulted in many a machine being "scrapped" before its full period of service was realized.

Bound Brook (Graphite and Bronze) and Nigrum (Impregnated Wood) Oil-less Bushings are a unique safeguard against the costly consequences of neglect. By having an inexhaustible supply of lubricant **built into them** at the factory, they

just like any other good bushing. On their bearing surfaces there are cast symmetrical grooves or trenches, varying in design according to the purpose for which the bushings are to be used. By means of hydraulic pressure these grooves are packed solid with a special hard lubricating graphite. The graphite and bronze surfaces are flush; they wear evenly; they require no refilling.

Nigrum Impregnated Wood Oil-less Bushings are made of hard, seasoned wood which is thoroughly impregnated with a specially prepared lubricating compound that never gives out. This is attained by a patented process resulting from years of study and experimentation. 391

There is no machinery of any kind that will not be more fully insured against



are able to function smoothly when the ordinary type of bushing would suffer from corrosion or want of proper attention.

Bound Brook Oil-less Bushings are constructed of high-grade phosphor bronze,



trouble by the use of "Bound Brook" or "Nigrum" Oil-less Bushings.

*Bound Brook Engineers will gladly study your lubrication problems and point out a method for their solution.*

## A. ALLAN & SON

HARRISON, NEW JERSEY

**Inventors and Sole Manufacturers of Allan Red Metal and Allan Bearing Bronze**

### **BEARING BRONZE:**

The addition of lead to bronze, where same is accomplished by a process that will assure the casting of an alloy of uniform physical structure, a bearing bronze is produced that will have exceptional wearing and anti-friction qualities.

392 Allan Bearing Bronze is our lead-copper-tin alloy, made of the proper proportions of virgin metals, so alloyed as to assure a uniform physical structure. An exceptionally high grade bronze for high speed and heavy duty service. The bronze that will cut cost and upkeep on your mill pinions.

### **ALLAN RED METAL:**

This alloy is not, strictly speaking, a Babbitt metal, nor can it be classed as a bronze, it just fits in the intermediate field, to do such work where white Babbitt metals will not give satisfaction, as they readily change their form with an increase of temperature and yet conditions in many cases are such that it is impossible to use a bronze. Allan Red Metal com-

bines the best qualities of the Babbitt and bronze alloys. It has the high anti-friction qualities of the Babbitt class with the temperature-resisting qualities of the bronze class.

Where will you find a bronze or Babbitt alloy that will stand up to the following service?

As shaft packing on steam turbines as a substitute for carbon.

As piston rod packing for locomotive service where temperatures run up to 650° Fahr.

As a bearing face for steam pistons with 150 pounds pressure and 200° superheat.

Allan Red Metal for many years has been meeting these service conditions and also overcoming troublesome conditions in crank pin, crosshead and motor bearings where white Babbitt metals have proven inefficient for the service conditions.

## A. ALLAN & SON



TRADE MARK

For over a quarter of a century we have been manufacturing bearing alloys, Allan Red Metal and Allan Bearing Bronze, our lead-copper and lead-copper-tin bearing alloys. They are made by The Allan Process, invented by Andrew Allan, Sr., in 1876. This is the only process which makes possible the alloying of lead-copper and lead-copper-tin in any desired proportion and assures the production of castings of uniform physical structure.

Our new plant at Harrison, N. J., is the highest attainment in foundry construction and equipment and is under



TRADE MARK

able metallurgical and mechanical supervision.

No orders too large or too small for prompt attention.

**393**

Estimates gladly furnished from blue prints.

Alloys sold in ingots and castings.

On long runs we prefer to make the necessary patterns.

On short runs we prefer to work from customers' patterns or we can furnish the patterns at nominal cost.

## AMERICAN BRONZE CORPORATION

GENERAL OFFICES AND WORKS:  
BERWYN, PENNSYLVANIA

Manufacturers of "Non-Gran" High Speed Bearing Bronze

### TESTIMONY EXTRAORDINARY:

These extracts are taken from what is perhaps the most remarkable set of letters ever written in the interests of a government investigation of bearing bronzes. They point unmistakably to the high regard in which NON-GRAN is held by many of America's foremost manufacturers.

#### Long Life:

394

"—up to the present day we have not a single record of ever replacing a cam shaft bearing or a valve guide bushing or any main bearing where the bronze material, NON-GRAN, was at fault."

#### Economy:

"—our shop losses due to defective bronzes of other makes have been so high as to force us to use NON-GRAN for conditions where a cheaper metal—were it reasonably sound—would otherwise satisfy our needs."

#### Uniformity:

"The homogeneity of NON-GRAN Bronze Bushings, their uniform quality and freedom from flaws and other de-

fects have made them almost indispensable to our service."

#### Structure:

"The freedom from granular structure in NON-GRAN Bronze Bushings has reduced shaft wear to a minimum."

#### Non-Scoring:

"NON-GRAN Bronze Bushings will run hotter without scoring than any other bronze we have ever used. In fact, in our experience with NON-GRAN we have never had a scored bearing."

#### One Formula—One Method—One Result:

"The writer believes in the efficiency of strict specialization, as in the case of the American Bronze Corporation's determination to make the best bearing bronze possible."

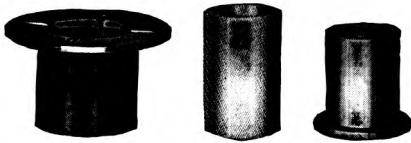


HIGH SPEED  
**NON-GRAN**  
BEARING BRONZE

# AMERICAN BRONZE CORPORATION

## FINISHED BUSHINGS:

We *specialize* on the finishing of plain straight bushings and plain straight bushings with flange at one end.



We undertake the finishing of these two specialties in long runs only.

We do not finish any shapes other than the above two, and we finish these only when the inside diameter is two inches or less.

Oil grooves, oil holes, slots, chamfers, etc., are provided as called for.

Our standard tolerances:  $\pm .0005$ " on diameters;  $\pm .005$ " on over-all lengths;  $\pm .0025$ " on flange thicknesses. Work held to closer limits where required.

For quotations, note respective quantities on backs of your blue-prints. We furnish all necessary pattern equipment.

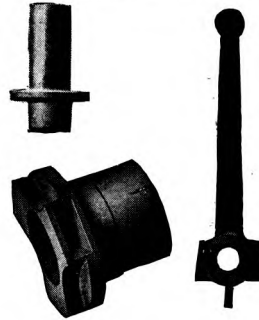


## CASTINGS:

We cast NON-GRAN to any pattern of any size, with no cores, straight cores or intricate cores as required.

Use brass shrink rule and allow  $\frac{1}{16}$ " stock all over for finishing on castings up to about 3"—more, in proportion, on larger castings.

On short runs we prefer to work from customers' patterns. On long runs we prefer to make the necessary pattern equipment.



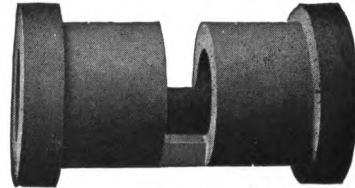
For pattern work we charge merely our own costs for the labor and material involved.

All NON-GRAN Castings are sand-blasted and rigidly inspected before shipment.

We supply NON-GRAN Castings in any quantities from one up.

For quotations, send patterns or sketches and state quantities.

395



## STANDARD 12" BARS:

Outside diameters,  $\frac{1}{2}$ " up to 5" by eighths.

Inside diameters,  $\frac{1}{2}$ " up to 3" by eighths.

NON-GRAN HIGH-SPEED NBB BEARING BRONZE

Supplied in any combinations of the above outside and inside diameters.

Write for list of standard combinations of O. D. and I. D. which are carried in stock for immediate shipment from Berwyn or from Official NON-GRAN Bar Distributors in all important cities.

Because of high tin contents NON-GRAN cannot be rolled or drawn but must be cast to pattern. In ordering NON-GRAN Bars therefore allow  $\frac{1}{16}$ " stock all around to permit of your machining down to the finished dimensions of the part.

## THE BUNTING BRASS & BRONZE CO.

726 SPENCER ST., TOLEDO, OHIO

Manufacturers of Bronze Bushings and Bearings



Every manufacturer who uses bronze bushings to the extent of 100 of a kind can cut his costs by buying **Bunting Bushings**.

396 Often this condition is true on 50 bushing lots, particularly in the larger sizes.

But cost is not the only consideration.



Bunting Bushings have a harder bearing surface due to a patented machining process.

In an average bronze alloy (80% copper, 10% tin and 10% lead) the inside bearing surface of a Bunting Bushing gives a Scleroscope reading of 30 as against a reading of 18 for a bushing as ordinarily machined.

Also Bunting Bushings are accurate and splendidly finished.

In the Bunting laboratory skilled chemists are continually at work analyzing all incoming metals.

Tests are regularly made to insure maintenance of the standards required by our customers.

At present we have on file one hundred and seven alloy compositions.



A customer who specifies any one of these alloys gets exactly what he specifies.

When you consider that a variation of so little as one per cent. in tin, lead or zinc frequently entirely changes the character of the resultant metal, the matter assumes real importance.

We make and list over ten thousand standard bushings and bearings.

We work from blue prints, accurate dimensions or correct samples—prints preferred.

Perhaps the most vital advantage of all is the service given to Bunting customers. Our shop facilities, largest in [the world in



this particular field, enable us to meet the delivery requirements of our customers.

*Quotations upon request.*

## JOHNSON BRONZE COMPANY

NEW CASTLE, PA.

### BRANCH OFFICES

NEW YORK

DETROIT

PITTSBURGH

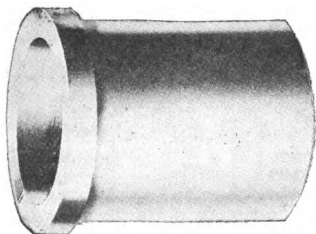
CHICAGO

J. E. Dockendorf & Co., 20 Broad St., N. Y. City

The Parker Co., 165 Broadway, N. Y. City

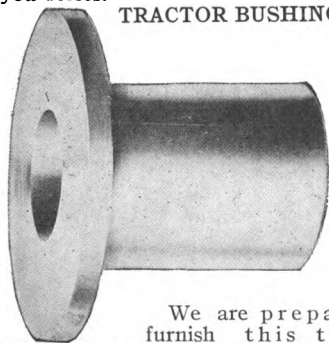
**Manufacturer of Bronze Bushings, Automotive, Tractor, Car and Locomotive, Mill Bronzes**

### AUTOMOBILE BUSHINGS:



We carry in stock large quantities of standard automotive bushings and patterns to meet rush orders in large quantities. A great part of our modern plant being devoted solely to this particular type of bushing gives the customer unlimited service and prompt deliveries. The hard bearing surfaces and splendid finish of these bushings delivered ready to assemble have made them the choice of many of the leading automobile manufacturers. What are your requirements? Do you want them by the carload or in lots of 100? We will be glad to quote you prices.

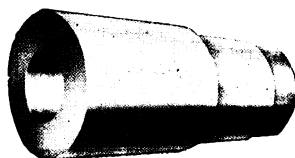
### TRACTOR BUSHINGS:



We are prepared to furnish this type of bushing in any quantity, machined or rough. These bushings used in the assembly of tractors and adopted as the standard by many of the leading manufacturers, are noted for their high compressive strength.

They are especially made to withstand the uneven strains and severe shocks of the open fields. Send your blueprints in for a trial order. They will be carefully and promptly executed in a plant devoted to the production of a single product.

### CAR AND LOCOMOTIVE BEARINGS:

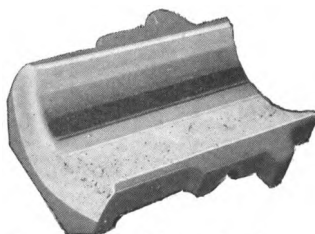


Our car and locomotive bearings are justly famed for their superior durability and efficiency.

We have devoted many years to the study of railroad requirements and now offer bearings that represent the greatest advance made in this particular field. Time proven by the most severe tests, they will withstand a greater amount of frictional pull than any bearing of this type on the market due to the fibrous structure and special alloys employed in their construction. A Bearing that is universally adopted wherever it has been given a trial.

397

### MILL BRONZES:



Designed to withstand the severe usage and unfavorable conditions of the rolling mills. We have made a thorough and scientific study of this problem from every angle. Our experiments have been rewarded in the production of a mill bronze that is unsurpassed in its imperviousness to granulation and scoring. The three factors which have combined to produce this bronze are the choice of the alloy, careful casting and rigid inspection.

Send us your blueprints and specifications. We know that we can give you better service, a better product, prompt deliveries and perhaps better prices—and we want a chance to prove it.



## LUMEN BEARING COMPANY

(Established in August 1901)

BUFFALO, N. Y.

Brass Founders

---



**Manufacturers of Brass and Bronze**

**398 Castings; Red Brass and Manganese**

**Bronze Ingot; Babbitts and Solders.**

**Twenty brass and bronze casting alloys**

**in regular production, including the**

**famous Lumen Bronze. Ask for the**

**booklet describing them.**

**Government Bronze—Ordinance, Navy,**

**Aircraft and Motor Transport Section.**

**Nine babbitts and eight solders made**

**and carried in stock. They cover the  
range of engineering requirements.**

**Machine bronze, cored and solid bars—**

**a carload carried in stock in Buffalo in  
support of twenty dealers in twenty  
different manufacturing centers.**

**"The Right Bronze Means Economy."**



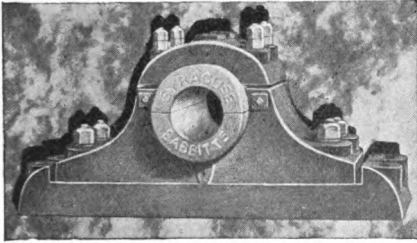
# UNITED AMERICAN METALS CORP'N

Syracuse Smelting Works Subsidiary

DIAMOND STREET AND MESEROLE AVE., BROOKLYN, N. Y.

Branches in Principal Cities

Manufacturers of Babbitt Metals, Solders, Phosphor Tin, Phosphor Copper  
Dealers in Tin, Lead, Antimony, Copper, Nickel, Spelter Bismuth, Aluminum



## GOVERNMENT GENUINE BABBITT:

For main engine bearings, crank-pins, motors. Highest grade of genuine babbitt. Brinell Hardness, 28.3 at 70 degrees F. Low coefficient of friction. Alloyed by the Stanley Process, assuring perfect amalgamation of elements.



## ALUMINUM GENUINE BABBITT:

A babbitt of exceptional strength and durability. Especially constructed to withstand severe impact, shocks, great pressure. Best babbitt for crushers, lumber-gangs, sugar centrifugals, etc.

## MASTER (Copper hardened) BABBITT:



Look for the splash of golden purple and the speckled trout effect—that's the indication of a perfectly alloyed copper hardened babbitt. Master Metal attains its great strength by reason of its alloying. Brinell Hardness about 27 at 70 degrees F. Does not shrink and therefore especially adapted for large bearings. Recommended for scored arbors because of its plasticity. For all high speeds and heavy pressures except in such extreme cases where Government Genuine or Aluminum Genuine is essential.

## MANGANESE ANTIFRICTION:

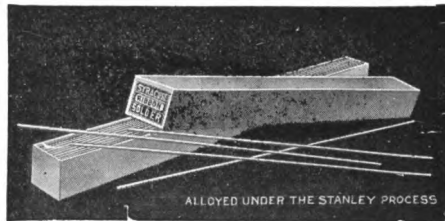


The ideal babbitt for all-round work. Flows like quicksilver. Runs cool under high speed because of its low coefficient of friction. Practically self-lubricating, a quality which is appreciated by every engineer. For woodworking machinery, cotton gins, sugar mills, saw mills, paper mills, dredgers, threshers, steam shovels, etc.

## SOLDERS, BARS, RIBBONS, DROPS:

Bar Solder cast in the following forms:  
Standard bar 15½" long, weight about 1¼ lbs.  
Boston bar 13¼" long, weight about ½ lb.  
Philadelphia bar 11¼" long, weight about 1¼ lbs.  
Capping bar 14" long, weight about ¼ lb.  
Ribbon Solder in 15" lengths packed 5 lbs. to a box or 30" lengths, 15 lbs. and 25 lbs. to the bundle. Better than wire.  
Aluminum Solder in ribbons ¼" wide, 15" long.

399



## PHOSPHOR TIN:

Stanley Process Grade. For delicate ornamental work, this flux is absolutely essential. Used by the largest foundries in America.

## PHOSPHOR COPPER:

Stanley Process  
Both 15% and 10% grades. Makes the castings dense and workable. Drives out impurities. Use it when working with scrap metals.

## FOR GALVANIZERS:

Stanbrite, the galvanizing flux, thins the bath and keeps it clean. Brings out the spangle. Saves spelter.

## OTHER PRODUCTS:

Sheet white metals, lead washers, brazing spelter.

## RAW MATERIALS:

Tin, lead, antimony, copper, spelter, bismuth, nickel, aluminum.



# ALUMINUM COMPANY OF AMERICA

PITTSBURGH, PA.

## BRANCH OFFICES

ALBANY  
BALTIMORE  
BOSTON  
CHICAGO  
CLEVELAND  
DALLAS

DETROIT  
INDIANAPOLIS  
KANSAS CITY  
NEWARK  
NEW YORK

PHILADELPHIA  
PITTSBURGH  
ROCHESTER  
SAN FRANCISCO  
ST. LOUIS  
WASHINGTON

CANADA, Northern Aluminum Co., Ltd., Toronto  
ENGLAND, Northern Aluminium Co., Ltd., London  
LATIN AMERICA, Aluminum Company of South America

## ALUMINUM:

Ingot	Casting Alloys
Sheet	Foil
Rod	Wire
Tubing	Mouldings

## Fittings

400 Electrical Conductors

Bronze Powder

Lithograph Plates

## FABRICATED ALUMINUM:

Automobile Hoods

Fenders

Stampings

Tanks

Pans

Coils

Pipe Lines, and Miscellaneous Apparatus for Chemical, Fruit Juice and other Manufacturers.

## ELECTRICAL CONDUCTORS:

The use of Aluminum for electrical conductors is rapidly increasing. Its properties make its use desirable in electrical construction and it is now being successfully used for:

High Tension Transmission Wire

Railway Feeders

Bus-Bars, etc.

Aluminum cable with steel reinforcement is now extensively employed for High Tension Transmission Lines.

## LITOT SOLDERS AND FLUX:

## LITERATURE:

Descriptive matter, containing valuable information for the user of Aluminum in any of its various forms, will gladly be sent to those interested.

*Brass, Tubing, Extruded Metal, Copper Wire*

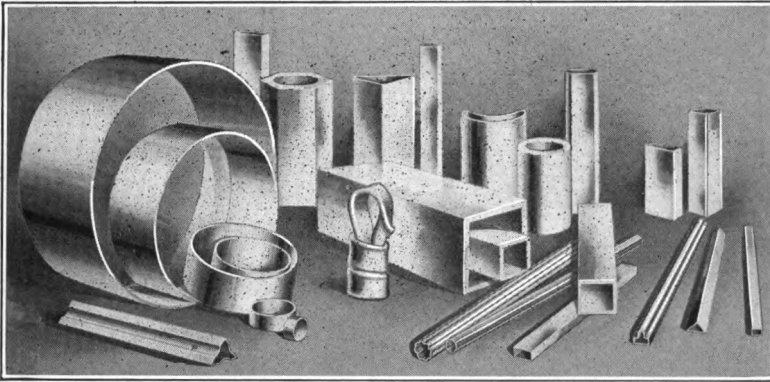
# THE AMERICAN BRASS COMPANY

WATERBURY, CONNECTICUT, U. S. A.

## MILLS AND FACTORIES

Ansonia Branch, Ansonia, Conn.  
Benedict & Burnham Branch, Waterbury, Conn.  
Buffalo Branch, Buffalo, N. Y.

Coe Brass Branch, Torrington, Conn.  
Kenosha Branch, Kenosha, Wis.  
Waterbury Brass Branch, Waterbury, Conn.



### BRASS AND COPPER TUBES FOR EVERY ENGINEERING REQUIREMENT:

Admiralty and other special grades of Condenser Tubes.

Ferrule Tubes, Heater Tubes, Pump Tubes.

Brass and Copper Locomotive Tubes.

Tobin Bronze and Phosphor Bronze Tubes for Bearings.

Brass and Copper Tubes in Iron Pipe and Plumbers' sizes.

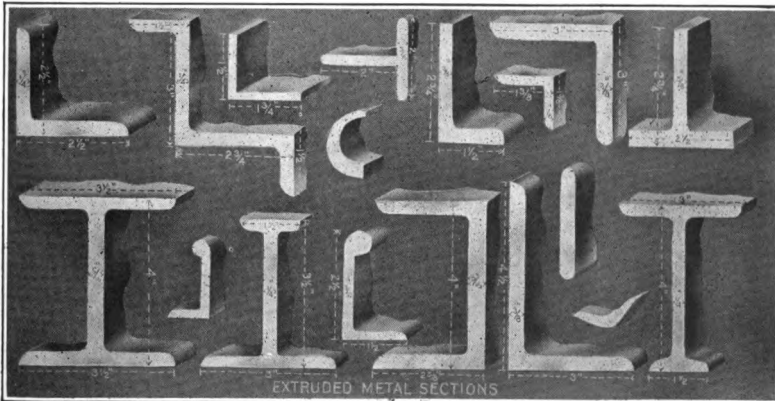
### HIGH TENSILE STRENGTH RODS AND BARS ADAPTABLE FOR A GREAT VARIETY OF ENGINEERING PURPOSES:

Tobin Bronze, remarkable for its Toughness and Resistance to Corrosion.

Free Cutting Rods, Naval Brass and Phosphor Bronze Rods.

Extruded Irregular Shaped Bars, Heavy Angles, Channels, and Mouldings made from forgeable alloys of both Brass and Bronze.

Turbine Blading and Calking Materials.



CATALOGUE AND PRICES SENT UPON REQUEST

## UNITED LEAD COMPANY

111 BROADWAY, NEW YORK CITY

Offices in All Principal Cities

Specialists in Lead Products

LEAD WOOL    LEAD PIPE  
LEAD ROPE    TRAPS AND BENDS  
SHEET LEAD    TIN PIPE  
LEAD, TIN, BRASS AND COPPER  
LINED IRON PIPE  
ACID RESISTING VALVES

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**Ulco Lead Rope:** The object of manufacturing finely divided lead in continuous strands in the form of rope is to provide Plumbers, Steam Fitters, Metal Workers, Engineers, etc., with a repair material available at once without heating or other preparation, to repair leaks in gas, steam and water pipes or masonry, and in power plants.

**Under Water:** Lead Rope can be placed in joints totally submerged.

**Repairing Old Joints    Calking Inverted Joints**  
**Burst Pipes                Leaks in Masonry**

**Holding Bolts:** For holding bolts in cement and masonry, no material equals Lead Rope.

**For Alignment and Leveling:** No material equals Lead Rope for lining bearings, leveling sinks, tubs, closets, etc.

**Roofers:** There are many uses for Lead Rope about roofs and skylights.

**Metallic Packing:** Wrapped in cheese cloth or sheet rubber, Lead Rope makes an efficient and satisfactory metallic packing.

**Gaskets:** Lead Rope folded in cheese cloth or rubber and placed between flanges of high pressure lines make a strong gasket.

**Calking Tools:** We furnish full sets of calking tools for all size pipes.

For making Metallic Packing we put up Lead Rope in smaller sizes. This material is sold lubricated or not, as requested. For stuffing boxes and valve stems the lead rope should be thoroughly saturated with graphite and oil. For making gaskets it is wrapped in cheese cloth and saturated with graphite and oil.

**Lead Wool:** For calking cast iron and riveted steel pipe for gas and water mains. Since it is not necessary to heat it, it cannot shrink like a cast lead joint. Used extensively for high pressure mains.

**Lined Products:** Lead, tin, brass and copper lined iron pipe—Fittings, lead and tin lined, flanged or threaded. All of this class of products lined by the United process which inseparably bonds or fuses the two metals. Let us help you figure on your Water, Acid, or Food Product piping problems. Write for catalogue.

### BABBITT METALS:

All lead, tin, antimony, arsenic, copper alloys for use as Bearing or Casting Metals.

Write for catalogue of the particular product in which you are interested.

*"Anything Made of Lead."*

# AMERICAN VULCANIZED FIBRE CO.

Established 1873

WILMINGTON, DELAWARE

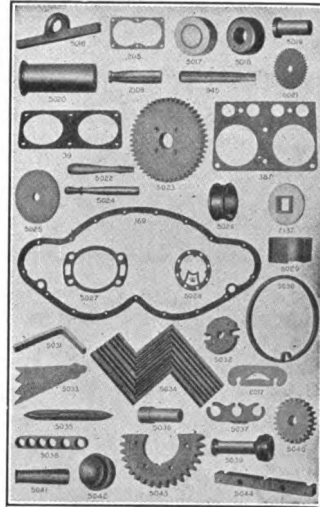
## VUL-COT FIBRE:

(A higher development of vulcanized cotton fibre.)

"VUL-COT Fibre" is the trade name of an extra fine quality of vulcanized cotton fibre, manufactured by the first producers of this material in America—the holders of the original patents, and for many years the sole American manufacturers. An experience, covering nearly half a century, has enabled them to produce a quality of fibre that is pure in content and flawless in structure. Only pure raw material is used.

The manufacturing processes are carried out under skilled supervision. Each stage is accurately and scientifically controlled. All traces of chemicals are removed. A rigid system of analysis, testing and inspection ensures this.

If you would be certain that the fibre used in your plant or product is the best quality obtainable, be sure that **VUL-COT** Fibre is specified. It is sold in sheets, rods and tubes of all standard sizes, or finished parts machined to your specifications.



403

## PHYSICAL PROPERTIES OF VUL-COT FIBRE

Tensile Strength	9,000-14,000 lbs. per sq. in.
Compressive Strength	32,000-37,000 lbs. per sq. in.
Resistance to Shearing	9,000-13,000 lbs. per sq. in.
Electrical Rupture	150-400 volts per .001 thickness
Specific Gravity	1.2-1.5

We maintain an Engineering Department to help you get the greatest good from the use of **VUL-COT** Fibre. Put your problem up to them. Samples, prices, and the interesting booklet "The Material of a Million Uses" will be sent you promptly upon request.

## THE CONTINENTAL FIBRE CO.

NEWARK, DELAWARE

NEW YORK OFFICE  
233 Broadway

PITTSBURGH OFFICE  
301 Fifth Ave.

CHICAGO OFFICE  
332 S. Michigan Ave.

SAN FRANCISCO OFFICE  
525 Market Street

LOS ANGELES OFFICE  
411 South Main Street

The principal products of this Company are Vulcanized Fibre, Conite, Bakelite-Dilecto and Continental-Bakelite. Although manufactured primarily as Insulating Materials, their exceptional physical qualities render them adaptable to a wide range of Mechanical Applications.

### BAKELITE-DILECTO:

404 Bakelite-Dilecto is an insulating material made of paper laminations impregnated with liquid Bakelite pressed together and hardened. It is manufactured in the form of sheets, tubes and rods. There are two sizes of standard sheets, 30" x 40" and 37" x 37" which may be obtained in any thickness from 0.005" to 3". Tubes are made 36" long with inside diameters of not less than  $\frac{3}{8}$ " and outside diameters of not more than 6" with any wall thickness  $\frac{1}{8}$ " and over. Rods are made from  $\frac{1}{8}$ " to 3 $\frac{1}{2}$ " diameter.

While Bakelite-Dilecto is a laminated material the laminations are so thoroughly saturated with Bakelite that the resultant product is practically homogeneous. Its many remarkable qualities adapt it to a wide range of purely mechanical uses.

Bakelite-Dilecto may be easily sawed, filed, machined and drilled in any direction without splitting or cracking. It saws like bone and turns like a soft metal such as copper. It can be punched successfully up to  $\frac{1}{8}$ " in thickness with a plain die. Drilling makes a clean, smooth hole which taps easily, leaving clean, sharp threads.

The resistance to heat of Bakelite-Dilecto is remarkable. It will withstand a dry heat of 200° F. continuously and 300° F. for a short time without softening, blistering, cracking or change of shape.

When tested for mechanical strength Bakelite-Dilecto behaves in a manner similar to cast iron. It has an average tensile strength of 10,000 lbs. per square

inch, and under compression will test 20,000 lbs. per square inch parallel to the laminations and 50,000 lbs. per square inch perpendicular to the laminations.

**Special Shapes:** Finished articles from Bakelite-Dilecto sheet or tube, completely machined to exact gauge ready for assembling, will be furnished in accordance with design. Quotations on finished or semi-finished articles together with samples of work done will be gladly submitted upon receipt of specifications. Inquiries for this class of work are solicited.

### CONTINENTAL-BAKELITE:

Continental-Bakelite is a laminated material made of cotton duck impregnated with liquid Bakelite pressed and hardened. It is made by the same process as Bakelite-Dilecto and may be obtained in the same sizes of sheets, rods, tubes and special shapes. It has the same physical and chemical properties but is somewhat weaker mechanically.

**Gear Stock:** The most important property of Continental-Bakelite is its extreme toughness which makes it an ideal material for noiseless gears. When meshed with a steel gear it takes up the shock because of its low modulus of elasticity of about 300,000 lbs. per square inch making a smooth and quiet running gear. Being water-proof, it will not soften or lose its mechanical strength under any weather conditions. The oil absorption is practically zero.

A gear made of Continental-Bakelite will, under ordinary conditions, take the place of a cast iron gear of the same size and have about the same life. The teeth of such a gear need no shroud, are stronger than, and will outwear the teeth of any other non-metallic gear.

We are also makers of high grade Vulcanized Fibre and Conite, the best thin fibrous insulating material.



# DIAMOND STATE FIBRE COMPANY

BRIDGEPORT, PA.

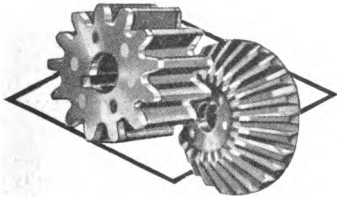
(Near Philadelphia)

OFFICES IN PRINCIPAL CITIES

## DIAMOND FIBRE:

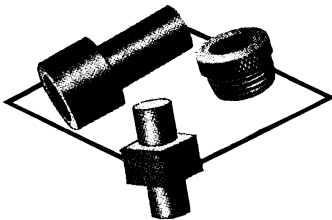
### A Remarkable Material

Efficient methods demand efficient materials. In the present period of reconstruction hard or vulcanized fibre has become a recognized factor. Diamond fibre especially, because of its purity, its uniform quality, its extreme toughness and its high degree of shearing, compression and tensile strength, has won the confidence of leading engineers the world over. The result is that it is used



today in hundreds of places where brass, iron, steel, hard rubber, glass, wood, mica, leather, etc., were once thought to be indispensable.

Diamond Fibre is a most efficient material, lending itself readily to the most



intricate machining process with but little wear or tear on edge tools. It is unaffected by grease or oil—has a high coefficient of friction—is a remarkable non-conductor of electricity—and will take practically every manufacturing process except moulding.

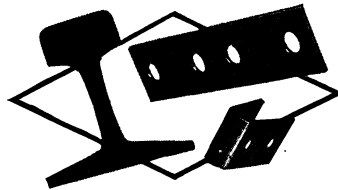
We produce Diamond Fibre in three basic forms—sheets, rods and tubes.



A Mark of Quality  
A Sign of Service

We also make it in special forms. We are prepared to produce—and we make a specialty of—gears, pinions, sprockets, gaskets, bushings, washers, cleats, machining ferrules, and many other special shapes.

In fact if "it" can be made of Diamond Fibre we are prepared to make it. Fully equipped machine shops and a complete supply of stock in both our Bridgeport, Pa., and Chicago, Ill., plants

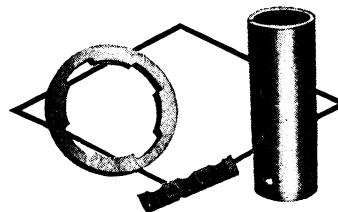


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enable us to give prompt service to patrons both East and West. We are at all times prepared to make prompt shipment of either raw stock or Diamond Fibre machined to specifications.

Diamond Fibre receptacles and trucks are well known in thousands of factories, mills and stores.

Diamond Insulation and Disfco In-



sulation are two high grade insulating papers. They possess extreme bending qualities and high dielectric strength.

Have you a problem? Maybe Diamond Fibre will help solve it. Write us and let us try.

# BAYONNE CASTING COMPANY

BAYONNE, N. J.

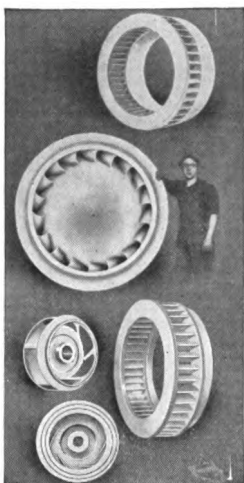
Monel Metal Castings: Rods, Bars, Wire (Round and Flat)

Monel Metal Forgings: Bolts, Nuts, Ribbon



**MONEL METAL** is an alloy which will withstand acids, high temperatures and the erosive action of hot gases and superheated steam.

## Definition and Physical Characteristics:



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Monel Metal is not a synthetic alloy, but is a natural combination of nickel and copper (approximately 67% nickel, 28% copper and 5% other metals) and is refined without changing the relation of the important elements.

The ore is refined and distributed for fabrication in the form of rods, castings, forgings, tubes, wire, strip stock, and sheets. Monel Metal can hardly be distinguished from pure Nickel in color; in tensile properties it closely resembles steel, being tough and ductile and

can be machined, forged, soldered, brazed and welded by the electric or oxy-acetylene method. It can be cast in many very intricate patterns and in this form is of unusually high tensile strength. Castings have been produced in this metal ranging in weight from a few ounces to 25,000 pounds each.

## Table of Physical Properties

Melting Point.....	1360° C. (2480° F.)
Weight per Cu. In. (Cast).....	0.319 lb.
Weight per Cu. In. (Rolled).....	0.323 lb.
Coefficient of expansion (20° C.-100° C.).....	0.00001375 per 1° C.
Electrical Resistivity, 256 Ohms per mil-foot (Temp. Coefficient).....	0.0011 per 1° F.
Heat Conductivity.....	1/18 that of copper
Shrinkage.....	1/4" per foot
Hardness Cast Material.....	20-23 (Shore Scleroscope)
Hardness Hot Rolled Rods.....	27 (Average Shore Scleroscope)
Hardness, Hot Rolled Rods.....	162 (Average Brinell)
Modulus of Elasticity.....	22,000,000-23,000,000

## Test on Rods Tensile

	Up to 1 inch	Over 1 1/2 inches
Yield Point, Lbs. per Sq. In.....	63,126	47,335
Ultimate Tensile Strength, Lbs. per Sq. In.....	94,562	84,763
Per cent Elongation in 2".....	40%	43%

## Torsional (Average)

Shearing stress—Lbs. per sq. in. on remotest fibres:	
At Elastic Limit.....	31,796
At Ultimate Load.....	79,053

## Compression

Elastic Limit... 25,500 to 32,000 lbs. per sq. in.

## Tests on Castings

### Tensile

Yield Point.....	37,093 lbs. per sq. in.
Tensile Strength.....	72,281 lbs. per sq. in.
Elongation in 2 In.....	34%
Reduction of Area.....	32%

## Compression

Elastic Limit... 12,000 to 25,500 lbs. per sq. in.

Monel Metal is superior to the majority of the metals in ordinary use both where its tensile and torsional strength at high temperatures are concerned. The results of many of these tests have been compiled in catalogue form and will be furnished upon request.

**Uses:** Monel Metal has proved superior used in appliances using high pressure superheated steam, salt water, having extremely high temperatures, using acid solutions at various temperatures, etc.

**Stock Sizes:** Made up in commercial forms as rods; rounds, squares, hexagons, rectangles, half-ovals; castings; forgings; wire, annealed and hard; tubes; sheets, etc.

## Rods

Rounds.....	1/8" to 2" by 1/8ths
	3/8" to 3" by 1/4ths
	3" to 6" by 1/4ths
Squares.....	1/4" to 2" by 1/4ths
Hexagons.....	1/2" to 2" by 1/4ths

## Nickel Castings:

After conducting extensive experiments during the past two years with the cooperation of The International Nickel Co., to develop a process for the casting of Nickel, we are now in a position to furnish Nickel castings of over 97% purity to consumer's specifications.

Nickel and Nickel Alloys are becoming a more important factor in the chemical industry.

*We solicit the opportunity of developing with you your possible requirements for pure Nickel castings.*

**SEND FOR OUR BOOKLET "M"**



## DOEHLER DIE-CASTING CO.

MAIN OFFICE AND EASTERN PLANT

BROOKLYN, N. Y.

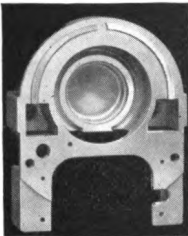
WESTERN PLANT: TOLEDO, OHIO

**Producers of Die-Castings in Brass and Bronze, Aluminum and White Metal Alloys; Babbitt-lined Bronze and ALUMINUM Back Bearings**

### DOEHLER DIE-CASTINGS

are **SUCCESSFUL DIE-CASTINGS**; produced by the leading and largest concern of its kind in the world; by an organization, and with an equipment both of which are the outgrowth of experience acquired by constant application and research covering a period of many years.

#### **ALUMINUM DIE-CASTINGS:**



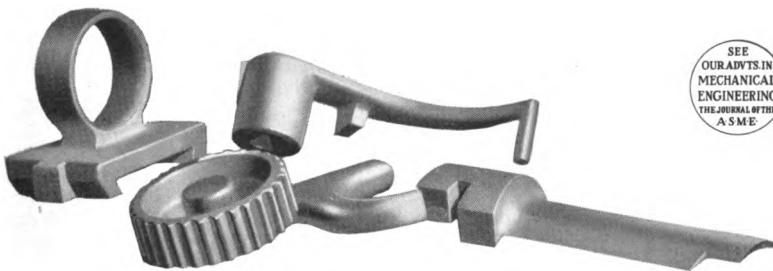
**Aluminum  
Die-Cast  
Magneto  
Frame**

The limitations of white metal die-castings led to our development of the process for the production of Die-Castings in Aluminum, by which the die-casting field was immeasurably broadened. DOEHLER ALUMINUM DIE-CASTINGS have all the characteristic features of our White Metal products, such as accuracy of detail, uniformity and smooth finish, with the additional quali-

ties of lighter weight combined with greater tensile strength. This product has within the past five years become an important factor in production economy, displacing, to an ever-increasing extent, the use of machine finished parts, where the use of white metal die-castings would not be practical.

#### **BRASS DIE-CASTINGS:**

BRASS DIE-CASTINGS, the production of which commercially has been the aim of the engineering profession for a number of years, are now successfully produced by us on a large scale under the trade name of "DO-DI" FINISHED **407** BRASS CASTINGS. In addition to all the desirable die-casting features "DO-DI" CASTINGS are absolutely solid and free from blow-holes, entirely eliminating, by their use, the waste caused by machining defective sand castings. The use of these castings, for the past three years, by the leading manufacturers of various metal products, has demonstrated their high quality and far-reaching possibilities towards effecting production economies.

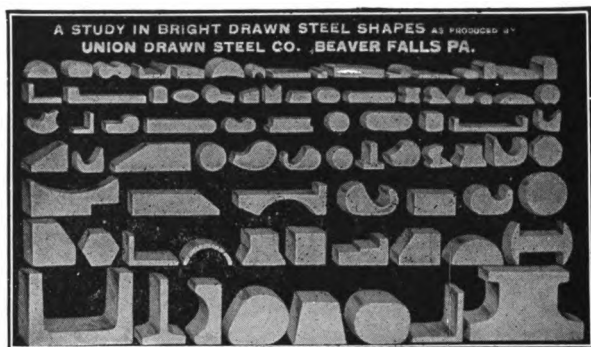


**FINISHED BRASS CASTINGS**

## UNION DRAWN STEEL COMPANY

GENERAL OFFICES: BEAVER FALLS, PA.

WORKS: BEAVER FALLS, PA., and GARY, IND.



**COLD DRAWN OR TURNED AND  
POLISHED:**

### 408 SHAFTING

**SCREW STEEL** { Bessemer  
Open Hearth

**ALLOY STEELS** { Nickel—1% and 3%  
Nickel Chromium  
Chromium  
Chromium—Vanadium, Etc.

**AXLES, PISTON RODS**

**SPECIAL SHAPES**

**SPECIAL CASE-HARDENING STEELS**

**Cold Finished Bessemer, Open Hearth,**

**Crucible and Electric Furnace Steels**

**Shafting:** We use only the best quality of Soft Steel and are manufacturing under recent patents, covering machinery and appliances, by a process superior to anything known for producing great

accuracy, a highly polished surface and the necessary straightness.

**Piston and Pump Rods:** Of special steels up to 70 or 60 feet long.

**Screw Steels:** For Automatic machine uses at high speeds.

**Elevator Guides:** Cold Drawn, Straight, with matched joints.

**Special Shapes of Cold Drawn Steel** made to meet your specifications; often more economical than castings and forgings where finished parts are needed.

*Complete Warehouse Stocks Carried at*

NEW YORK    DETROIT    CINCINNATI  
PHILADELPHIA    CHICAGO

Branch Sales Offices at BOSTON and  
BUFFALO.

## EDGAR T. WARD'S SONS CO.

BOSTON

NEW YORK

NEWARK

CHICAGO

PHILADELPHIA

Cold Rolled Strips, Bars, Sheets, and Tubes, Tool Steels, Fine Steel Wires

### HARDENED, TEMPERED, POLISHED AND BLUED STEEL STRIPS:

Our tempered stock is the finest Swedish Steel exact to thickness and width, nicely blued and of an excellent even temper. No other stock can be relied

upon for such uniformity of temper and accuracy to gauge.

#### In Stock

2500 sizes  $\frac{1}{16}$ " to 12" wide, .0015 to .095 thick.

### COLD ROLLED, ANNEALED TOOL STEEL [STRIP:

We carry in stock cold rolled tool steel, bright annealed (free from Scale) for small cutters, saws, springs, watch and instrument parts, etc.

2" x .001" and .002";  $3\frac{1}{4}$ " x .003", .004", .005"; 4" x .006" to .057"; in coils.

$5\frac{1}{2}$ " x .058", .060, .0625, .065;

$5\frac{1}{2}$ " x .070, .072, .075, .077, .083, .095, .101, .106, .109, .115, .120, .125, .134, .158 in 6 ft. lengths.

Hard Rolled, .005" to .051" in coils  $3\frac{1}{8}$ " wide.

Steel for Band, Butcher and Hack Saws; Steel Pens and Tapes

Soft Bright Cold Rolled Strip Steel

Dead Soft to bend both ways of grain.

For stamping, deep drawing, shims, washers, machine parts, etc.

.012" to .312" thick widths to 12".

#### Polished Drill Rod

Finest Tool Steel for small cutters, etc.

Flat Square Edge Cold Drawn Tool Steel,  $\frac{1}{8}$ " x  $\frac{1}{16}$ " to  $\frac{5}{8}$ " x  $\frac{3}{8}$ ".

Steel Tubes,  $\frac{1}{8}$ " diameter to 14". 1600 Sizes.

#### Ward's Gold Label High Speed Steel

Equals the best. Uniform, durable and easy to work.

#### Teenax Non-Shrinking Tool Steel

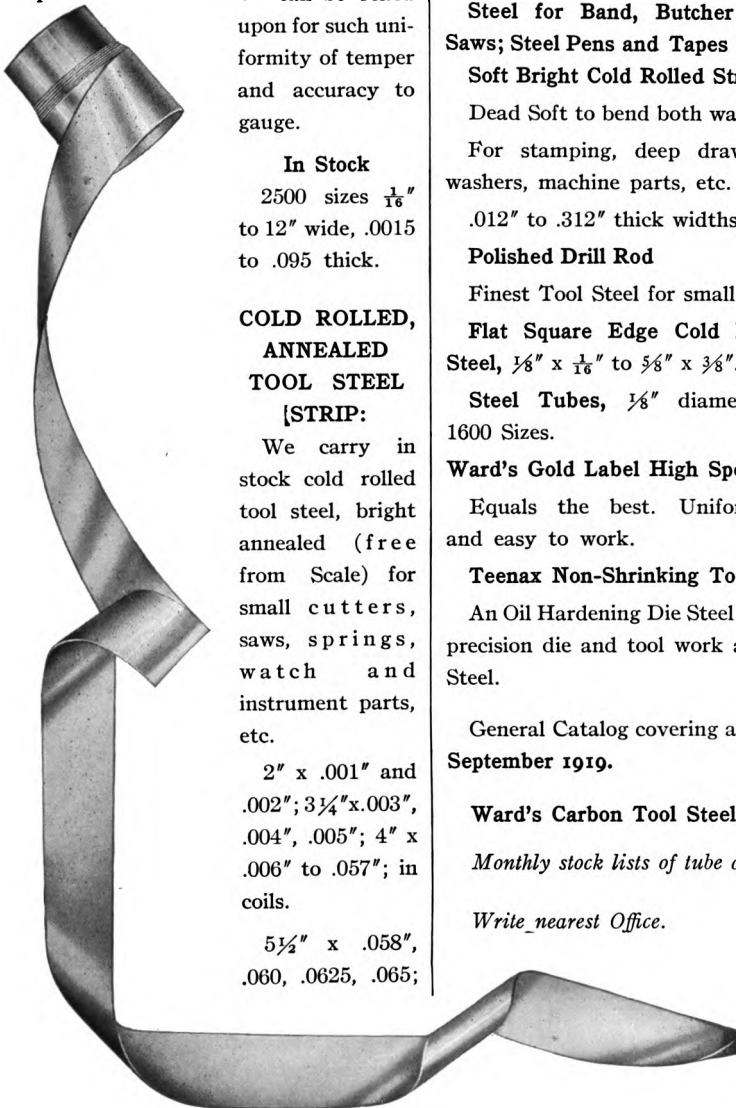
An Oil Hardening Die Steel for accurate, precision die and tool work a Permanent Steel.

General Catalog covering all lines ready September 1919.

#### Ward's Carbon Tool Steels

Monthly stock lists of tube and steels.

Write nearest Office.



## WHEELOCK, LOVEJOY & CO., INC.

128 Sidney St.  
CAMBRIDGE, MASS.

23 Cliff St.  
NEW YORK CITY

1800 Columbus Road  
CLEVELAND

1255 Book Bldg.  
DETROIT, MICH.

### High Grade Steels for Every Purpose

#### HY-TEN ALLOY MACHINERY STEEL:

HY-TEN is the result of twenty years' metallurgical research and practical development, with the object in view of obtaining a steel which combines the strength and toughness of high grade chrome, nickel and vanadium steels, together with the free machining qualities so often lacking in these alloy steels.

This problem has now been completely solved by gradual development and elimination so that the HY-TEN Steel of today, which is a chrome-manganese alloy, possesses remarkable strength and toughness combined with excellent machining qualities.

HY-TEN is furnished regularly in ten different grades to meet varying requirements for strength, toughness and machining conditions. There is a steel for case hardening, oil tempering, water quenching, etc., all of which can be furnished in hot rolled bars, cold drawn bars, forgings or discs, either in the natural condition, annealed or heat treated.

#### OTHER ALLOY STEELS:

We are prepared to furnish all of the standard grades of chrome-nickel, vanadium or other alloy steels for mill shipment.

This includes nickel steel from 1 to 5% chrome-nickel, vanadium, chrome-vanadium, etc., which can be furnished in any carbon and with any combination of alloys specified.

All of the standard grades such as those specified by the S. A. E. are carried on hand at the mill in billets so that they can be furnished promptly in the size, shape and finish desired.

#### CUTLERY STEELS:

Cutlery Steels of all types are furnished; any shape desired may be obtained whether the material is required in sheets, strips or bars. Information regarding our qualities of cutlery steels will be sent on request.

#### HIGH SPEED and CARBON TOOL STEELS:

Our High Speed and Carbon Tool

Steels are all manufactured from the purest of raw materials and in specially designed electric crucible furnaces.

This method of steel making produces the highest quality together with the greatest uniformity possible.

The adaptation of each grade of our Tool Steels to specific uses has been perfected through many years of experience with high grade steels, embodying careful and thorough study of the practical problems encountered in a manufacturing shop.

We offer a specific grade of Tool Steel for every special purpose including High Speed Tool Holder Bits, various grades of Carbon Steels, Special Alloy Steels for Twist Drills, Steels for Ball Bearings, Magnets, Chisels and other special uses. All of these steels have been designed to satisfactorily perform a certain duty.

#### DRILL RODS:

We handle a complete line of polished drill rods, needle wire and steel spring wire, as well as lime drawn rods, in several different grades of steel, also high speed drill rod.

A large range of round and square sizes ready for prompt shipment is carried at the mill and at our warehouses, while mill service is available for flats, triangles, ovals, hexagons, octagons or other special shapes, drawn as accurately as these shapes can be milled.

Our drill rods and wire are all drawn to micrometer caliper and are guaranteed to be of the highest quality, most accurate in size and of finest finish. Rods are soft and uniformly annealed to permit of easy and satisfactory machining.

The temper best suited for your requirements can be furnished in any of our grades.

*Send for Special Catalogues.*

**Mill and Warehouse Service.**

**Steels for Both Production and Equipment Requirements.**

# THE AMERICAN FORGE & MACH. CO.

CANTON, OHIO

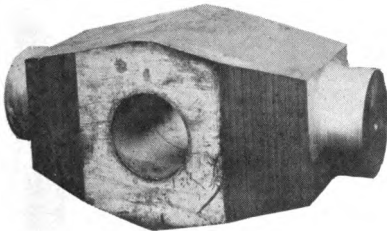
Manufacturer of Steel Forgings

## PRODUCT:

Drop and Drawn Forgings; all sizes of Crane hooks, Bridle or Porter chains for heavy hoisting; Links made from Chrome-Vanadium Steel with pins of the same material, all heat treated will give the most lasting chain material known; Tinning and galvanizing Rolls; Annealing box hooks; Gear blanks; Rider Blocks; Hot Mill Screws and other mill forgings.

## FACILITIES:

Our equipment is one of the best and most modern in our field. Our Drop Forge Plant includes steam drop hammers from 1200 to 5000 pounds, to which may be added a well equipped Drawn Forge Plant where are located two Steam Hydraulic Forging Presses.



Our machine shop is equipped with saws, lathes, boring mills, planers, shapers, etc., whose capacity is ample to take care of forgings weighing thousands of pounds.

Our heat-treating plant is one of the most modern in the country with regard to its equipment and is backed by experts in this art. This plant has been meeting the United States Government requirements as to heat treatment which is a paraphrase for excellent and accurate work.

## QUALITY:

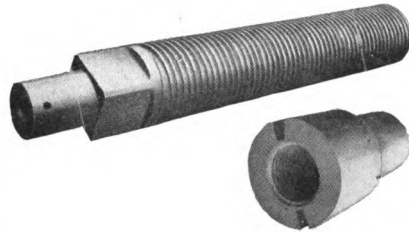
The materials used by us in our forgings are tried and tested results of laboratory experiments and our forging steel is guaranteed to us to be free from pipes, seams and laminations.



1800 Lb. Locomotive Driving Axle

## HOT MILL SCREWS:

We have developed a Hot Mill screw that will last under the trying service to which they are subjected. The combination of metal and heat treatment we put in our screws makes them outlast several ordinary screws.



We are specializing in these better housing screws and boxes and are prepared to fill orders with dispatch. They save time and money by reducing the number of shut-downs incidental to replacements and also the cost of many new screws.

## SERVICE:

We have been experimenting with and improving upon methods and processes of forging and heat-treating for years. All the valuable experience gained by our engineers and chemists reverts to our customers. Consult with our engineers concerning your forging propositions and let us solve your difficulties.

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## VULCAN STEAM FORGING CO.

247 RANO STREET, BUFFALO, N. Y.

**Makers of High Grade Forgings**

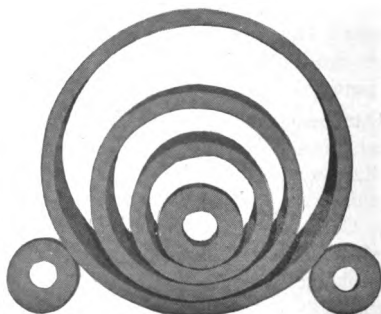
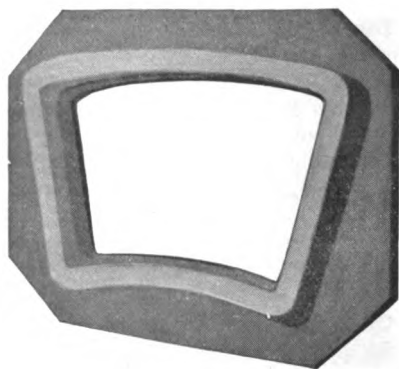
For twelve years we have been furnishing forgings to die makers, both jobber and manufacturer, and these the most successful and reputable in their respective lines. The results of our successful experience are tendered you in your requirements of crucible tool steel smooth forged Cutting and Draw Die Weldless Rings, Composite Dies and Punches, Circular Cutters, Shear Blades, and all other types of forgings used by die makers. These tool steels are straight carbon and alloyed, including a Non-Shrinking, Non-Warping type.

- 412 Where your machine or other part requires hardness, maximum of strength and resistance to fatigue, our Alloy steels under recommended treatment will secure these results. Gears, Axles, Spindles, Reamer bodies, etc., quickly furnished.

Do you require light and medium weight smooth forged machinery steel Crankshafts, Spindles, Rolls, Levers, Cutterheads, Gear Blanks, Cam Shafts, Cams, Gauge Rings, Shafting, or other machine parts? Our quality of workmanship will add to the satisfaction you possess in your own product.

Have your requirements in Ball Race Ring forgings been supplied? We are responsible producers of these made either of tool steel or special chrome steel.

*Your enquiries are earnestly solicited.*



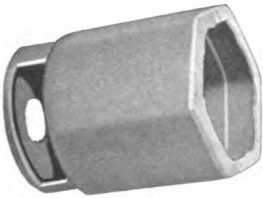
# THE BOSSERT CORPORATION

UTICA, N. Y.

Manufacturers of Sheet Metal Stampings

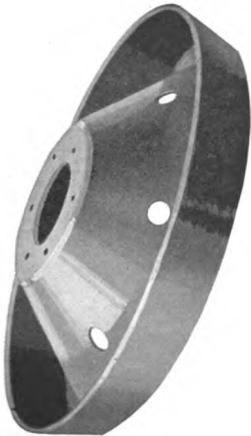
## BOSSERT STAMPINGS:

We are exceptionally well equipped for the manufacture of all kinds of sheet metal stampings from the smallest to the very heaviest and largest, as our equipment includes the largest mechanical



presses in the world, both single and double action presses, as well as single and double crank.

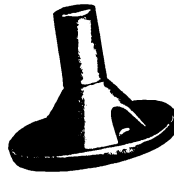
Our longest range of work is about 8' by about 5' wide; round work we can go up to about 5' in diameter up to



$\frac{3}{4}$ " thick and up to 6 and 7' in diameter up to  $\frac{1}{2}$ " thick.

We have had our equipment of presses built for large and heavy work, antici-

pating the probable future requirements of pressed steel parts on a much larger



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and heavier scale than they are being produced today, to take the place of all kinds of castings, forgings and work turned from the bar.

We make a specialty of Automobile and Tractor Axle and Wheel Parts.



With the largest presses in the industry and a complete and modern plant for annealing, case hardening, nickel plating, electric and oxy-acetylene welding, we solicit your inquiries and orders,

## WORCESTER PRESSED STEEL CO.

Factory and Main Office  
WORCESTER, MASS.

Light and Heavy Metal Stamping

CHICAGO OFFICE  
15 N. Jefferson St.

SAN FRANCISCO OFFICE (steel)  
1840 E. 15th St.

DETROIT OFFICE  
David Whitney Bldg.

SAN FRANCISCO OFFICE (stampings)  
Rialto Bldg.

INDIANAPOLIS OFFICE  
28 So. Meridian St.

BRIDGEPORT, CONN., OFFICE  
1646 Fairview Ave.

### HIGHEST QUALITY LIGHT AND HEAVY METAL STAMPING:

Deep Drawing, Cold Rolling, Cold  
Forging, Pressing.



414 Our entire organization and equipment,  
developed by 30 years' experience, are  
devoted exclusively to making special  
stamped parts for others from strip and  
sheet steel, brass, bronze, copper, alu-  
minum, silver, monel metal and the new  
steel alloys. We make all of our own  
tools. We pickle, oil, shear and cold-  
roll our own steel.

### SHEET METAL PARTS TO ORDER FOR:

Automobiles  
Axle Boxes  
Ball Bearings  
Bicycles  
Bowls  
Brackets  
Brake Drums  
Calculators  
Caps  
Cases  
Clutch Discs  
Cream Separators  
Cups

Dictographs  
Discs  
Electrical Fittings  
Flanges  
Guards  
Handles  
Hubs  
Ice Skates  
Lawn Mowers  
Looms  
Motorcycles  
Phonographs  
Pruners  
Pulleys  
Retainers  
Roller Skates  
Sheet Metal Specialties  
Shims  
Shock Absorbers  
Stampings  
Telautographs  
Telephones  
Textile Fittings  
Typewriters  
Vacuum Cleaners  
Wrenches

We also have one of the most completely  
equipped COLD ROLLED STRIP  
STEEL MILLS in the East, having a  
capacity of 5000 tons per month and pro-  
ducing strip steel up to 12" in width  
and from .005" to .375" in thickness.



**CATALOGUE SECTION  
PART VI**

**Metal Working Machinery  
Machine Tools  
Shop Equipment and  
Accessories**

415

**Pages 417-568**



# NIAGARA MACHINE & TOOL WORKS

Established 1880

BUFFALO, N. Y., U. S. A.

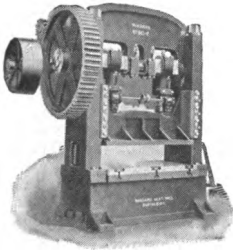
**Tools and Machines for Working Sheet Metals, Presses and Punches, Power Shears, Tinsmiths' Tools, Forming Rolls, Etc.**

Furnishing Tinsmiths, Sheet Iron Workers, and Sheet Metal Goods Manufacturers, the proper tools and equipment for efficient production, has been for forty years the exclusive work of this company. It offers machines for folding, bending, curving, crimping, beading, flanging, grooving, seaming, blanking, punching, perforating, forming, stamping, drawing, shearing, and other operations in Sheet Metals; hand tools, hand operated, and high production machines.

Competent Engineers are at your service. Inquiries are solicited.

## PRESSES:

Inclinable, Punching, Horning and Wiring, Arch, Straight Sided, Single



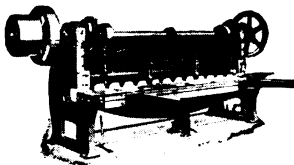
No. 615 E  
Press

Crank, Double Crank, Trimming, Toggle Drawing, Cam Drawing, Reducing, Screw, Foot, Drop, Bench and other types; built in sizes up to 75,000 lb. weight, for light or heavy sheet metal punching, cutting, blanking, bending, forming and drawing, also for trimming drop forgings.

## SHEARS:

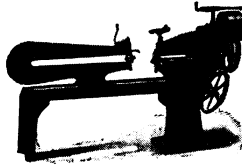
SQUARING Shears, foot operated, belt or motor driven; made in a full range of

No. 8120  
Shear



lengths from 2 to 16 feet, for any thickness of material up to and including

three-eighths inch; with or without gap. Niagara Shears make straight, accurate cuts the full length of the Shear. The gap is necessary for shearing sheets longer than the machine.



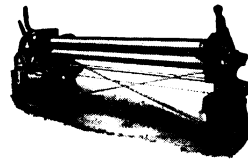
No. 16 A  
Ring Shear

ROTARY Shears, hand operated, belt or motor driven; built in many sizes; for light gauge, up to one-half inch capacity; with various depths of throat; in both ordinary and ring shear, or internal circle types; with circle arm for cutting discs and rings, or arranged for straight 417  
slitting, irregular cutting, etc.

## FORMING ROLLS:

Our Slip Roll Formers are made in diameter  $1\frac{1}{2}$ " to 7"; lengths up to 10 feet; capacity up to  $\frac{3}{8}$ "; for curving Sheet Metal, or forming to cylindrical shape;

6" x 120"  
Slip Roll



ordinary construction or with special features to suit requirements.

## SHEET METAL WORKERS' TOOLS:

Folders, Brakes, Beaders, Crimpers, Flangers, Groovers, Double Seamers, Elbow Machines, Stakes, Snips, Bench Shears, Rivet Sets, Hand Tools, Roofers' Tools, Notchers, Lever Shears, and Lever Punches, all in great variety of size and type.

*Complete catalog upon request.*

## E. W. BLISS COMPANY

MAIN OFFICE AND WORKS: BROOKLYN, N. Y., U. S. A.

CHICAGO

DETROIT

CLEVELAND

LONDON

PARIS

PRESSES, DIES, SHEARS, DROP  
HAMMERS, DOUBLE SEAMERS,  
SPECIAL MACHINERY

1857



1918

Tin and Enamel Ware Machinery

Metal Package Machinery

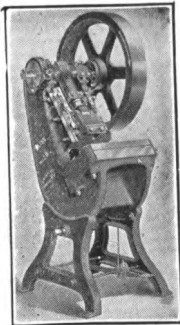
Automatic Tin Can Machinery

Electrical Parts Machinery

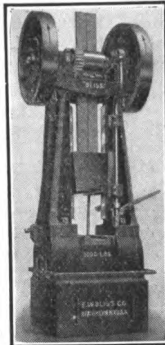
Automobile Parts Machinery

Drop Forging Machinery

418



**"BLISS" INCLIN-  
ABLE POWER  
PRESSES:** 18  
sizes, weighing  
from 500 to 8,000  
lbs., either as  
"Flywheel" or  
"Geared" Presses.  
Adapted for tin,  
sheet brass, sheet  
steel work, etc.



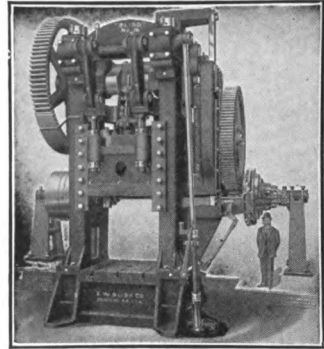
**"STILES" AUTO-  
MATIC DROP  
HAMMERS—**  
Built in 15 sizes.  
Adapted for forg-  
ing or stamping.  
Hammers weigh  
from 100 to 3000  
lbs.

**"BLISS" DOUBLE SEAMERS** (not illustrated):

Built in over 30 different types and sizes,  
weighing from 275 to 7,500 lbs. For double  
seaming the tops and bottoms on articles of  
square, round, oval and irregular shapes.

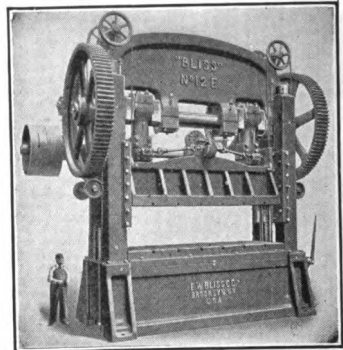
**"STILES" PUNCHING PRESSES** (see op-  
posite page):

11 sizes, weighing from 550 to 13,000 lbs.  
Adapted for the manufacture of general hard-  
ware, electrical goods, etc.



**"BLISS" TOGGLE DRAWING PRESSES:**

Built in over 20 sizes, weighing from 5,600 to  
165,000 lbs. For drawing shells from all kinds  
of sheet metal.



**"BLISS" STRAIGHT-SIDE DOUBLE CRANK  
PRESSES:**

Built in over 150 different types and sizes,  
weighing from 2,500 to 260,000 lbs. For heavy  
blanking, stamping and punching of large  
dimensions.

**"BLISS" KNUCKLE JOINT EMBOSSING  
PRESSES** (see opposite page):

Built in 12 sizes and various styles, weighing  
from 2,700 to 110,000 lbs. and capable of exerting  
pressures ranging from 30 to 1,500 tons.

**"BLISS" AND "STILES" OVERHANGING  
DOUBLE-CRANK PRESSES** (not illustrated):

Built in over 100 different types and sizes,  
weighing from 2,300 to 280,000 lbs. For heavy  
blanking, stamping and punching of large  
dimensions, etc.

*Catalogue of any line of our machines  
sent on request.*

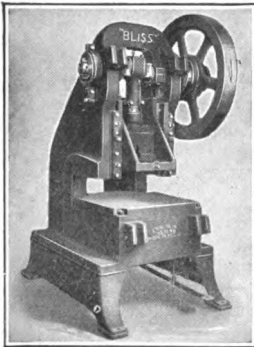
# E. W. BLISS COMPANY

**Our Product Includes MACHINERY AND DIES for the Economical Manufacture of the Following Sheet Metal Goods:**

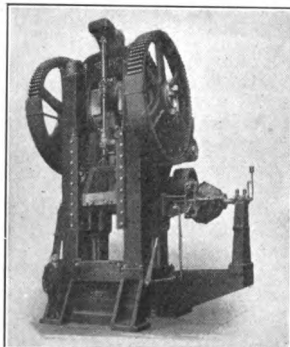
Agricultural Implements	Drip Pans
Albums	Door Knobs
Aluminum Ware	Drop Forgings
Armature Disks and Segments	Druggists' Tinware
Automobile Parts	Dust Pans
Bicycle Parts	Electrical Goods
Bird Cages	Elevator Buckets
Bottle Caps and Capsules	Enamel Ware
Brass Goods	Expanded Metal Laths
Brittania Ware	Fish Cans
Buckles	Forks
Burners	Fruit Cans
Butter Tins	Fry Pans
Cash Registers	Furniture (Metal)
Cigarette Boxes	Gas Fixtures
Clocks	Gas Ranges
Coal Hods	Gongs
Collapsible Tubes	Gun Parts
Cooking Utensils	Hammers
Coins	Hardware
Cornice Work	Harness Trimmings
Cuspidors	Hinges
Cutlery	Horse Shoes
Dental Instruments	Jewelry
Dinner Pails	Kitchen Boilers
	Kitchen Utensils

Lamps	Roofing
Lanterns	Rubber Cups
Lard Pails	Satchel Frames
Locks	Speaking Tubes
Match Boxes	Silver Ware
Meat Cans	Sheet Steel Sinks
Medals	Shingles (Metal)
Metallic Ceiling	Shovels
Metal Laths	Spoons
Metal Radiators	Sheet Steel Stoves
Musical Instruments	Steel Barrels
Oil Cans	Stove Trimmings
Oil Stoves	Thimbles
Perforated Metal	Tin Boxes and Cans
Paint Cans	Tobacco Boxes
Paint Tubes	Toys
Petroleum Cans	Trunk Trimmings
Pick-eyes	Typewriters
Pieced Tinware	Vapor Stoves
Plated Ware	Varnish Cans
Playing Cards (Cutting)	Vegetable Cans
Powder Kegs	Water Coolers
Range Boilers	Water Pails
Range Parts	Watches
Reflectors	Wash Tubs
Refrigerators	Zinc Work

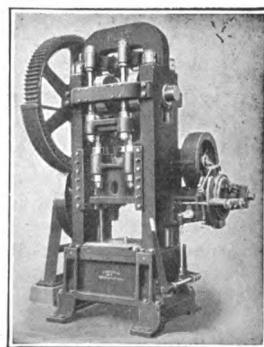
**And Many Other Staple and Special Lines of Goods.**



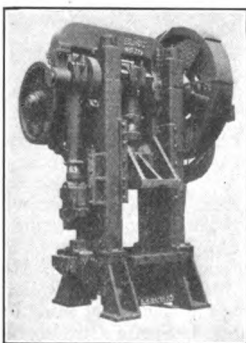
Cut Back Frame



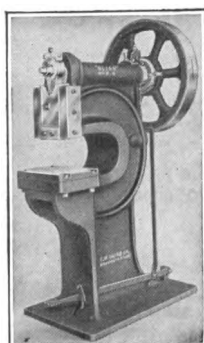
Straight Side Press



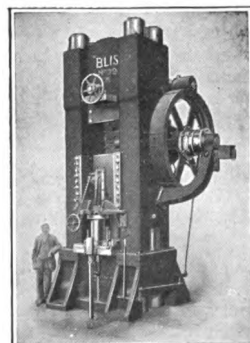
Double Action Cam



Trimming Press



"Stiles" Deep Throat



Knuckle Joint

## THE LONG & ALLSTATTER CO.

Established 1856

AMERICAN PUNCH & SHEAR WORKS

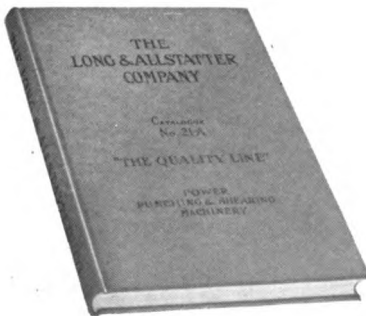
Incorporated 1878

HAMILTON, OHIO, U. S. A.

Manufacturers of Power Punches and Shears

### THE QUALITY LINE:

Power, Punching and Shearing Machinery for Shipyards, Steel Car Plants, Rolling Mills, Bridge and Structural Iron Works.



420

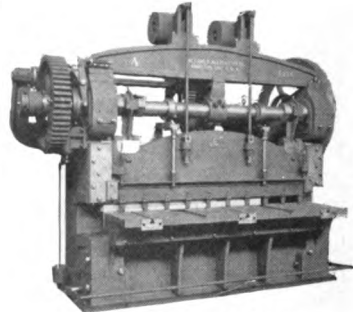
OUR NEW CATALOG is 7" x 10" and contains 304 pages. It illustrates and describes 267 machines, including Power Punches—Single—Double—Vertical and Horizontal, also Multiple Punches, for any number of holes. Power Shears for Bars—Plates—Angles—Channels and Special Shapes, also Angle Shears—Splitting Shears and Alligator Shears. It also shows Bending and Forming Machines—Riveting and Punching Machines—Automatic Spacing Machines and Special Machinery for Special Work.

The Electric Gag Control and the Floating Punch are shown and described as applied to Punching Machinery. Engineering data with tables of useful information are given which are of great value to the iron worker.

This is the most complete and the most interesting catalog ever issued covering this class of machinery.

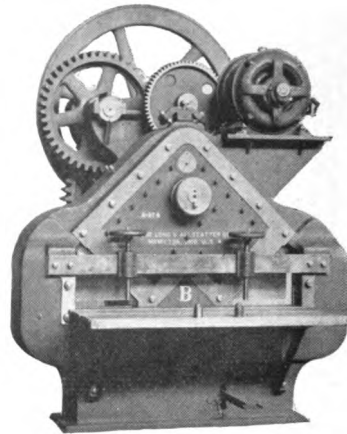
Every manufacturer of iron and steel and its products where our line of machinery is used should have this catalog. The Purchasing Agent needs it and the Superintendent wants it—"SEND FOR IT."

### GATE SHEARS:



Size No. A Gate Shear

Varying in width between housings and depth of throat to suit customer's requirements; to cut off and trim plates or sheets of any width from  $\frac{1}{4}$ " to  $1\frac{3}{4}$ " thick.



Size No. B Angle Shears

### ANGLE IRON SHEARS:

These machines are built in different sizes to cut from the smallest to the largest angles, cutting them off square or to a miter of 45 degrees. Made with or without turn table, to drive by belt or motor.

WE ALSO MAKE Bar Iron Shears, Bending and Forming Machines, Horizontal Punches, Bulldozers, Plate Splitting Shears, Punching and Riveting Machines, Splice Bar Punches, Sprue Cutting Machines, Alligator Shears, and Hand and Automatic Speed Spacing Tables.

## THE LONG & ALLSTATTER CO.

Established 1856

Incorporated 1878

HAMILTON, OHIO, U. S. A.

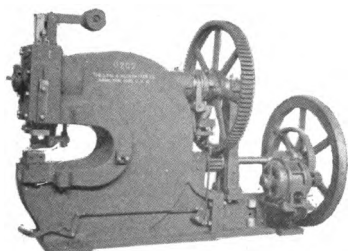
Manufacturers of Power Punches and Shears

### THE QUALITY LINE:

Power Punching and Shearing Machinery of all kinds for Shipyards, Steel Car Plants, Rolling Mills, Bridge and Structural Iron Works.

### PUNCHING MACHINES

### SHEARING MACHINES



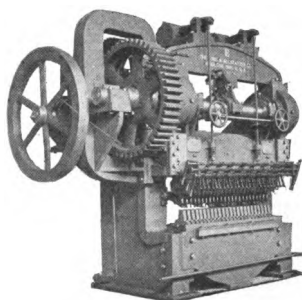
Single Open Throated Punch

A Complete line of open throated type, large and small, single and double machines, belt, steam or electrically driven (at customer's option) for general purpose use; to do all kinds of ordinary punching or shearing.

These machines can be modified in various ways to meet the requirements of purchaser.

*Write us regarding your problems in punching and shearing—correspondence solicited. Estimates furnished on request. If interested, you may have a catalogue for the asking.*

### MULTIPLE PUNCHES

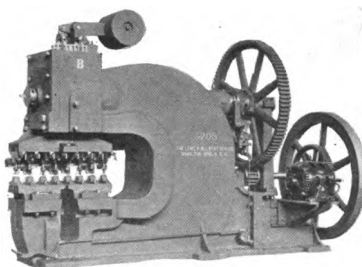


Multiple Punch

Varying in width between housings and depth of throat to suit customer's requirements; to punch any number of 421 holes, in groups or in rows, with fixed or adjustable centers.

### COPING MACHINES

### STRUCTURAL PUNCHES



I-Beam Punching and Coping Machine

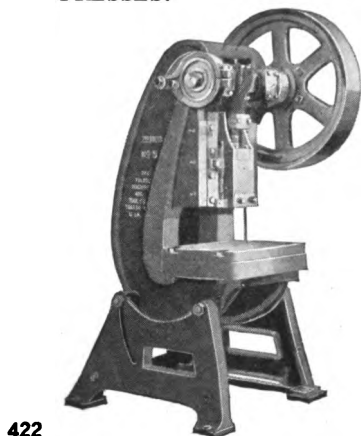
A full line for punching and coping structural sections (beams, channels, angles, etc.) of all kinds and sizes with the widest range of equipment.

## THE TOLEDO MACHINE & TOOL CO.

TOLEDO, OHIO, U. S. A.

Builders of Presses, Dies, Shears, Drop Hammers, Cam Drawing Presses, Circle Cutting Shears, Double Seaming Machines, Forging Presses, Horning Presses, Knuckle Joint Presses, Shovel Making Machinery, Spinning Lathes, Sprue Cutters, Etc.

### THE "TOLEDO" OPEN BACK PRESSES:

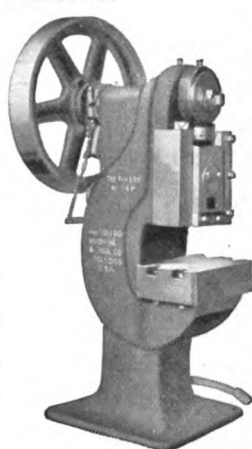


422

shaping and combination die work. Illustrated in our catalog, Section No. 2-A.

Series No. 1 and 70. Built in 30 sizes, weighing from 500 to 60,000 lbs. They are adapted for a great variety of work, including nearly every kind of blank cutting, forming, perforating, drawing, and combination

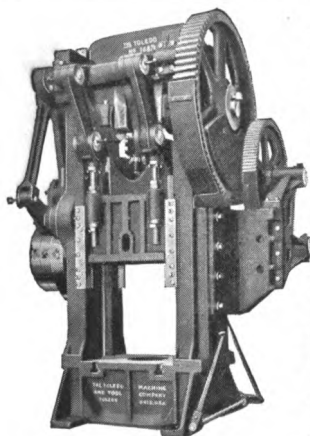
### THE "TOLEDO" PUNCHING PRESSES:



stock. Illustrated in our catalog, Section No. 4.

Series No. 30. Built in 15 sizes, weighing from 700 to 15,000 lbs. These presses are extensively used for a large variety of work, being especially suited for punching, shearing and cutting out blanks of heavy metal—steel, iron, brass, etc.; for operating trimming and forming dies, using bar and sheet metal

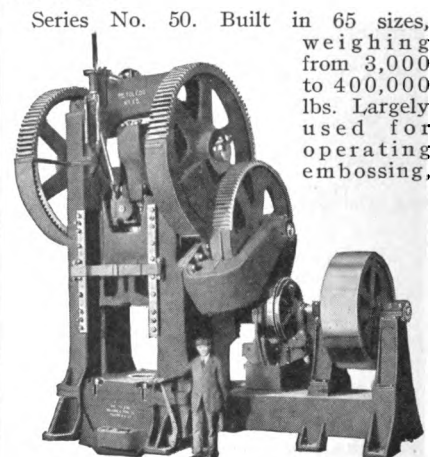
### THE "TOLEDO" TOGGLE PRESSES:



radiators, steel stove parts, elevator buckets and innumerable other articles made from brass, copper, aluminum, steel or tinplate. Illustrated in our catalog, Section No. 8.

Series No. 160. Built in 50 sizes, weighing from 75,000 to 650,000 lbs. These presses are unexcelled for drawing stamped steel and enameled ware, seamless steel bathtubs, metallic caskets, automobile bodies,

### THE "TOLEDO" STRAIGHT COLUMN PRESSES:



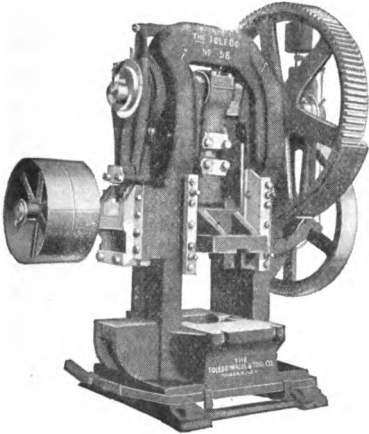
cutting and drawing dies, and reducing dies; for punching, piercing, shaping and stamping heavy blanks; also for trimming drop forgings, either hot or cold. Illustrated in our catalog, Section No. 6.

Series No. 50. Built in 65 sizes, weighing from 3,000 to 400,000 lbs. Largely used for operating embossing,



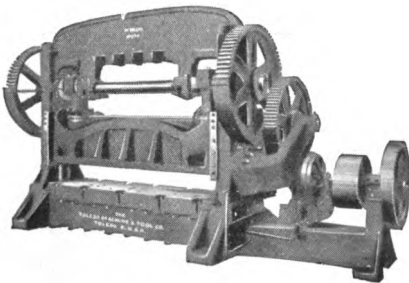
## THE TOLEDO MACHINE & TOOL CO.

### THE "TOLEDO" TRIMMING PRESSES:



Series No. 50. Built in 20 sizes, weighing from 4,500 to 200,000 lbs. These presses are especially adapted for use in drop-forging plants for trimming drop-forgings, either hot or cold, such as crank shafts, gear blanks, agricultural implements, hardware specialties and many other articles too numerous to mention. Illustrated in our catalog, Section No. 9-A.

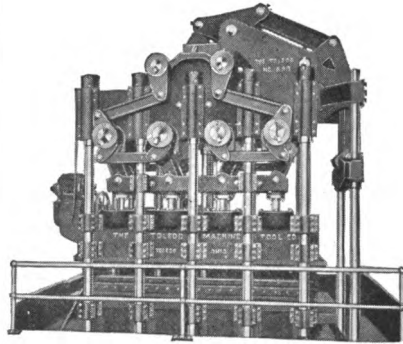
### THE "TOLEDO" DOUBLE CRANK PRESSES:



Series No. 90. Built in over 200 sizes, weighing from 4,500 to 500,000 lbs. These presses, with either Straight Column or Overhanging Frames, embody the most advanced ideas in the construction of machines of this class.

Their general uses are for cutting out and forming large articles in tin, brass, copper, sheet steel, cardboard, paper, cloth, etc. Illustrated in our catalog, Section No. 7.

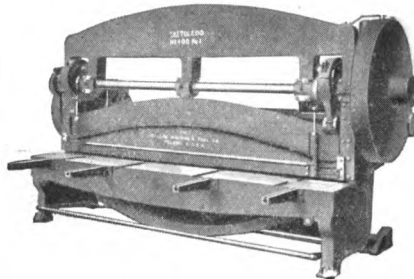
### THE "TOLEDO" RAIL FORMING PRESSES:



Series No. 890. Built in 4 sizes, weighing from 350,000 to 750,000 lbs. These have been especially designed for forming "rails" of channel section such as are used for automobile frames and similar work that calls for great accuracy and absolute uniformity, free from warping and buckling. Illustrated in our catalog, Section No. 8.

423

### THE "TOLEDO" SHEARS:



Series No. 400 and 7500. Built in 100 sizes, weighing from 1,500 to 100,000 lbs. These shears are noted for the ease, rapidity and accuracy with which they perform their work. They are used by many metal goods manufacturers, and in the largest tinplate and steel mills, being subjected to continuous hard usage. Illustrated in our catalog, Section No. 11-A.

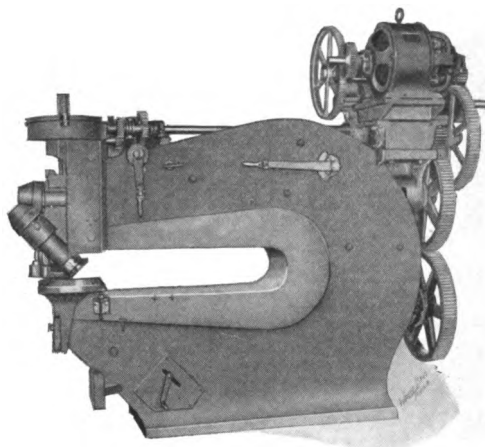
**Three Thousand Patterns from  
which to choose.**

*Correspondence Solicited  
Estimates Furnished*

## THE QUICKWORK COMPANY

ST. MARY'S, OHIO

Manufacturer of Plate and Sheet Metal Working Machinery



Patented June 3, 1913

424



### ROTARY SHEARS:

**Made in 7 Sizes.**

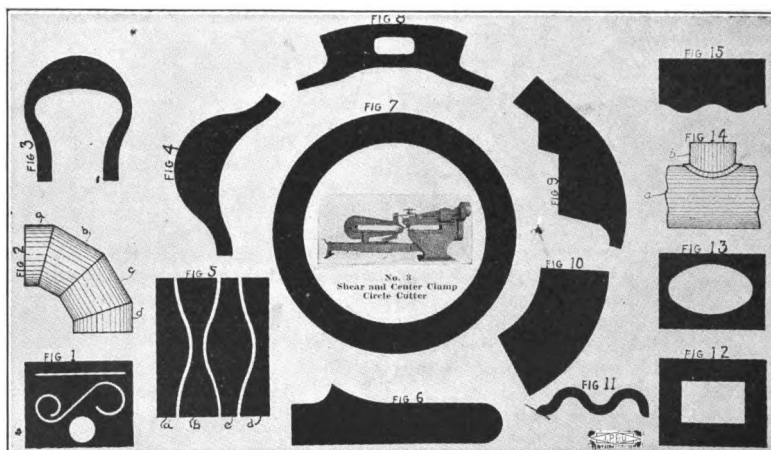
Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square true

edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.

**Save 50% to 90%.**

Eliminates oxyacetylene cutting and plate planing.

*Write for catalogue.*



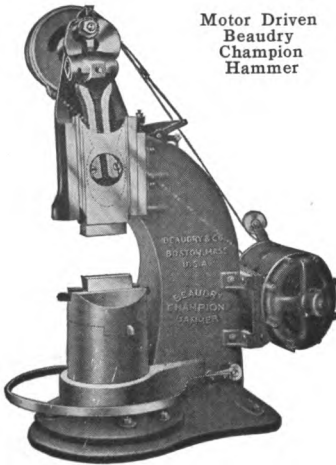
A Few Typical Shapes and Openings that Can Be Cut on "Quickwork" Rotary Shears

# BEAUDRY & COMPANY, INC.

141 MILK ST., BOSTON, MASS.

Manufacturers of Beaudry Power Hammers (Belt or Motor Driven)

**BEAUDRY CHAMPION HAMMERS** are built in sizes from 50 to 500 lbs. weight of ram. They are designed for light and heavy railroad, machine, and general blacksmithing; for swaging, collaring, drawing, plating, spindle-making, and general manufacturing. They will handle varying thickness of stock without change of adjustment and combine quickness of action with a powerful blow.



The Beaudry Champion Power Hammer has many claims to favor, but its foremost claims are *elasticity, control, and force of the blow struck by it*. These are obtained by a device which is simple,

direct-acting, and effective, allowing the ram the greatest freedom of throw and causing it to rebound the instant the blow is struck. Its ram, or "Head," is of steel and has an internal elliptical-shaped track. Two steel spring arms, with hardened tool steel rollers at their lower extremities, operate within the ram, upon the curved track, and serve to lift and throw the ram, which, with increased speed of hammer, acquires increased travel and force of blow. This simple and positive action of the spring arms perfectly controls the ram and causes it to rebound the instant the blow is struck without reaction or jump or sudden undue strain on any of the hammer parts.

425

**Bars of Any Length May Be Worked Either Way of Dies:**

**Motor Driven Hammers:** Beaudry Champion Hammers are readily arranged for motor drive. We are prepared to quote on these hammers complete with motor, or we will quote on hammers arranged for motor drive, customer to supply his own motor.

*Our new Catalog will interest you. Gladly sent on request.*

## SIZES AND DIMENSIONS CHAMPION POWER HAMMER

No. of Hammer	2	3	4	5	6	7	8	9	11	12
Weight of Ram, lbs.	50	75	100	125	150	200	250	300	400	500
Estimated Force of Blow, lbs.	300	450	600	750	900	1200	1500	1800	2400	3000
Lift of Ram, inches	6	7	8	8½	9	10	11	11½	12½	13
Average Size of Work, inches	1½	1¾	2¼	2½	3	3½	4	4½	5	6
H. P. of Motor	3 H.P.	3 H.P.	5 H.P.	5 H.P.	5 H.P.	7½ H.P.	7½ H.P.	7½ H.P.	10 H.P.	10 H.P.
Speed of Motor when directly attached to Hammer frame	900	900	900	900	900	850	850	850	850	850
Speed of Hammer	300	300	275	275	250	225	225	200	175	175
Diameter of Driving Pulley, inches	14	14	16	16	17	18	18	19	20	22
Face of Driving Pulley, inches	3	3	3½	3½	4	4	4½	5	6	7
Approx. Weight of Hammer, lbs.	2000	2400	3000	3200	3700	4400	4800	5400	7000	9000

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## C. C. BRADLEY & SON, INC.

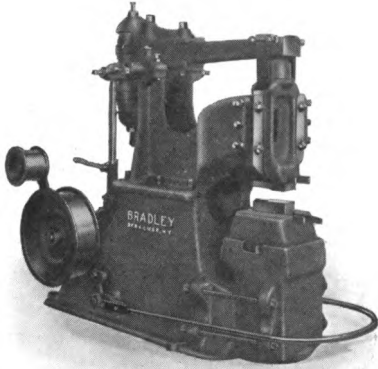
Established in 1832

SYRACUSE, N. Y.

Manufacturers of Bradley Cushioned Power Hammers and Forges

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### THE BRADLEY UPRIGHT HELVE HAMMER:



**426** BRADLEY HAMMERS are made in Helve, Upright Strap, Upright Helve, and Compact styles, with heads ranging from 15 lbs. to 500 lbs., and capable of forging iron, steel and other metals from five inches square down.

If your work is continuous, like plating, drawing, swaging, collaring, welding or spindle work, with infrequent changes in size of material, or if it is die work where perfect accuracy and the finest finish are imperative, let the Bradley Helve Hammer be your choice. No other Hammer is like it. No other Hammer can equal it.

If your work is of a general, all-around jobbing character, with frequent variations in the size of stock, or is of such a

nature that the Hammer is not worked continuously, but with frequent stops, a Bradley Upright Strap Hammer may best answer the purpose.

But if the work is continuous and severe, the Hammer running without rest hour after hour, day in and day out, the Upright Helve would answer a better purpose.

If your work is such as described last above, and your floor space is limited, but with good height, and a somewhat less first cost is an object, we suggest the Bradley Compact Hammer.

*More Bradley Hammers are sold each year than of all other power Hammers combined. Separate circulars of each.*

### WE MAKE:

**The Bradley Cushioned Helve Hammer,  
The Bradley Upright Strap Hammer.  
The Bradley Upright Helve Hammer.  
The Bradley Compact Hammer.  
Forges for Hard Coal or Coke.**

### FOREIGN AGENTS:

England—Buck & Hickman, Ltd., London, Brazil, France, Belgium, Switzerland, Italy, Spain and Portugal. Fenwick, Freres & Co., Rue de Rocroy, Paris

# THE MASSILLON FOUNDRY AND MACHINE COMPANY

MASSILLON, OHIO

Manufacturers of Steam Drop Hammers, Steam Forging Hammers, Double and Single Frame, Air Operated Hammers

## THE "MASSILLON" STEAM DROP HAMMER:

Made in all sizes from 600 lb. to 15,000 lb. falling weight.

Embraces all the features of the most modern ideas in Drop Hammer construction.

All Massillon cylinder lids are of the Safety Steam Cushion type, preventing any possible damage to operator or machine should rod pull out or break and fly up to top of cylinder under steam or air pressure.

The Massillon Steam Drop Hammers have no superior anywhere and are the best for all classes of Drop Forgings.

## MASSILLON DOUBLE FRAME STEAM FORGING HAMMER:

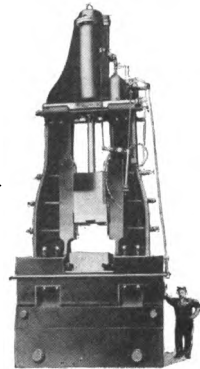
Made in all sizes from 600 lb. to 10,000 lb. capacity. These hammers contain all the latest improvements and while the illustration shows the straight style ram these can be furnished with skewed ram where desired.

## MASSILLON SINGLE FRAME HAMMER:

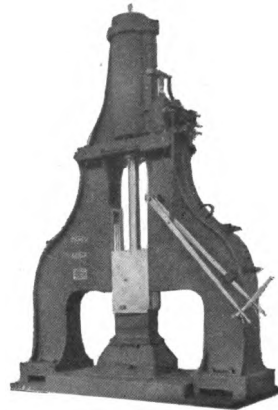
These hammers are of the latest design, will strike any desired force of blow, and with the unusual strength and thorough workmanship, permanent durability is ensured.

Work of any length can be welded, drawn and finished either way of the die. Adjustable guides take up wear of ram. Valve gear is simple and substantial, giving perfect control of the hammer and takes up its own lost motion by gravity. Buffer springs stop ram at top of stroke. An automatic oil pump lubricates both valves and cylinder. Can be operated equally well with compressed air.

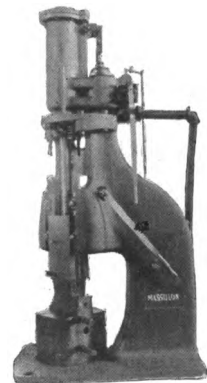
The "Massillon" Steam Drop Hammer



Double Frame Steam Forging Hammer



Single Frame Steam Hammer



427

## WILLIAMS, WHITE & CO.

MOLINE, ILLINOIS, U. S. A.

PITTSBURGH OFFICE  
808 House Building

NEW YORK OFFICE  
C. H. Holbrook  
30 Church St.

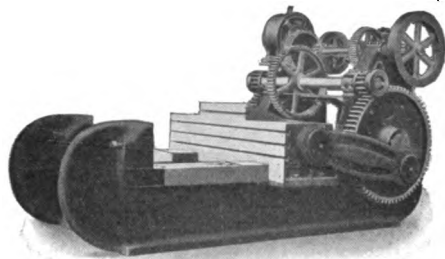
DETROIT OFFICE  
J. C. Austerberry  
924 Dime Bank Bldg.

CHICAGO OFFICE  
933 Monadnock Block

### Forging, Punching and Shearing Machinery

#### BULLDOZERS:

Over forty years of Bulldozer manufacturing. These machines are used for an incredible number of purposes. General purpose Press

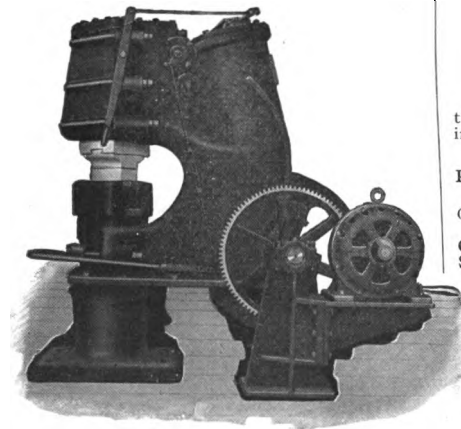


Bulldozer

**428** with practically unlimited possibilities. Built in ten sizes, and two types.

#### YEAKLEY VACUUM HAMMERS:

Recent and important improvements place this hammer at the head of Forging Hammers, both in power and control. Speed of blow is maintained, forging both light and heavy. Built in sizes from 40 to 650 lbs. Adaptable to motor drive.



YEAKLEY Hammer

#### JUSTICE SPRING HAMMER:

Silico manganese steel springs furnished.

#### MOLINE HELVE HAMMER:

Extra heavy in design.

#### BOARD DROP HAMMER:

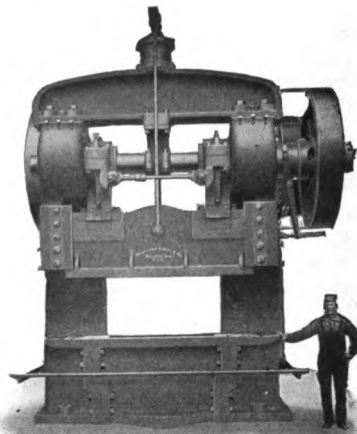
Very much improved. Exceptionally easy of operation and large output.

#### CRANK (OR ROPE LIFT) DROP HAMMERS:

Stand very severe service with comparatively small upkeep. Particularly adapted to the carrying of large dies, for bending, shaping, forming and straightening. Made in three styles of Lifters—Sandage, Ratchet and Peck.

#### MULTIPLE PUNCHES:

These machines are made in nine sizes with varying lengths and throats. Special adapta-



Multiple Punch

tions for special work furnished. Machines range in weight from 5,000 to 250,000 lbs.

#### PUNCHING AND SHEARING MACHINES:

"C" type, Double and Single End Machines. Open-fronted Bar Shears, and Guillotine Shears.

#### COPING AND STRUCTURAL PUNCHES AND SHEARS:

Complete line of the above machines, covering a wide range of throats, capacities, types of jaw, equipment, etc.

#### Our Line Also Includes:

Upsetting, Forging and Rivet Machines, Eye Benders, Multiple Head Tapping Machines, Bending and Straightening Machines, Horizontal Punches, Hydraulic Presses, Power and Trimming Presses, Stay Bolt Breakers, Rotary Riveting Hammers, Angle Bending Rolls and Angle Shears.

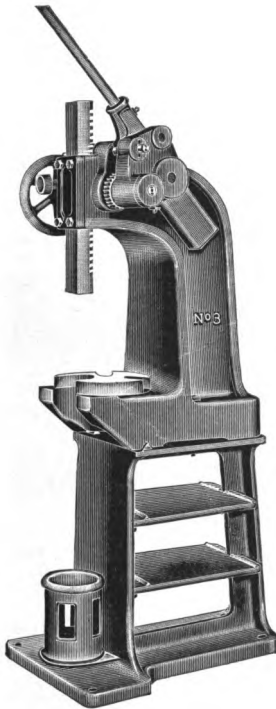
# ATLAS PRESS COMPANY

310 NO. PARK ST., KALAMAZOO, MICH., U. S. A.

Manufacturers of Atlas Compound Mandrel Presses

## EFFICIENT ARBOR PRESS EQUIPMENT:

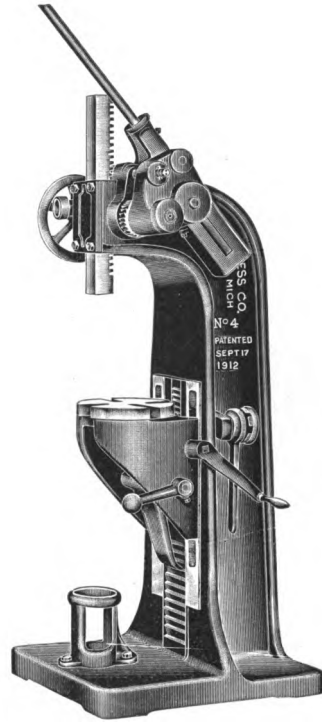
ATLAS PRESSES are built in all sizes and types for driving mandrels, bending and straightening, broaching, embossing with dies, setting bushings, etc. In fact, all work requiring pressure up to 25 tons and centering capacity up to 38 inches may be done quicker and easier on our *Compound Presses* than by any other method.



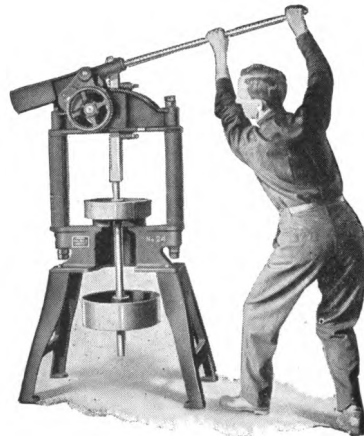
No. 3 on Stand

Pinions are cut from forgings of Chrome Vanadium—Rams from specially treated Chrome Nickel. All parts designed to give highest degree of efficiency under all service conditions. *Complete details upon request.*

Carried in stock by leading machinery dealers everywhere.



No. 4 Press



No. 24 Press

## THE ACME MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

Code Word: ACME

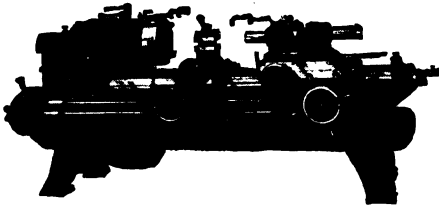
*Lieber's Code*

**Builders of Turret Machinery**

### CINCINNATI ACME

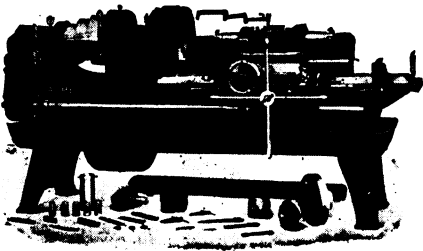
**FLAT TURRET LATHES, SCREW MACHINES, TURRET LATHES, BRASS WORKING MACHINES, UNIVERSAL TURRET LATHES, AND ALL TOOL ACCESSORIES:**

FLAT TURRET LATHES, the double purpose machines. Adapted to both bar and chucking work. Using simple, inexpensive tools. The greatest producers of work from bar stock, forgings and castings. Capacity bar stock  $2\frac{1}{4}$ " to  $3\frac{1}{2}$ " and chucking work 12" to 17" diameter.

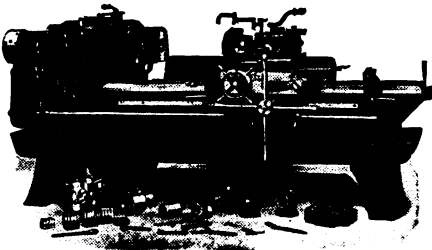


No. 3 Universal Flat Turret Lathe with Chucking Equipment

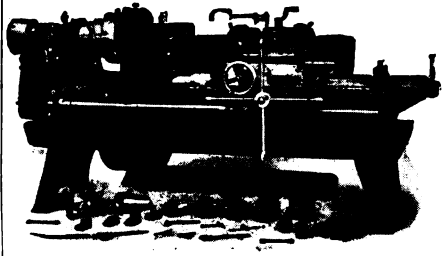
430



$2\frac{1}{4}$ " x 26" Flat Turret Lathe with Chucking Equipment

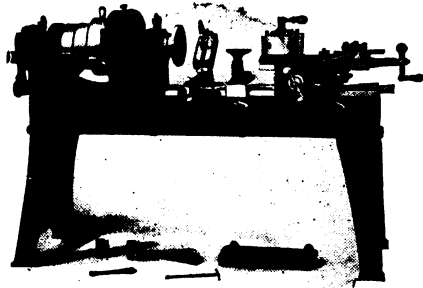


$3\frac{1}{4}$ " x 36" Flat Turret Lathe with Bar Equipment



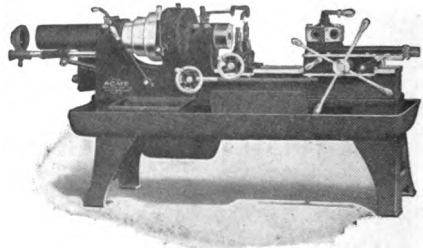
$2\frac{1}{4}$ " x 26" Flat Turret Lathe with Bar Equipment

TURRET LATHES AND BRASS MACHINES made in four sizes. 14" to 20" swing. Plain or friction geared head, with or without automatic chuck, bar feed, automatic feed to turret, or cut off rest. Furnished with plain, set over or universal turret, also chasing attachment, forming attachment and all tools for rapid and accurate production.



18" Universal Turret Lathe

SCREW MACHINES made in five sizes, Automatic Chuck capacity  $\frac{1}{8}$ " to  $2\frac{1}{4}$ ", 11" to 20" swing. Plain or friction geared head with or without automatic feed to turret.



$2\frac{1}{4}$ " x 11" Screw Machine



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# THE GREAVES-KLUSMAN TOOL CO.

CINCINNATI, OHIO

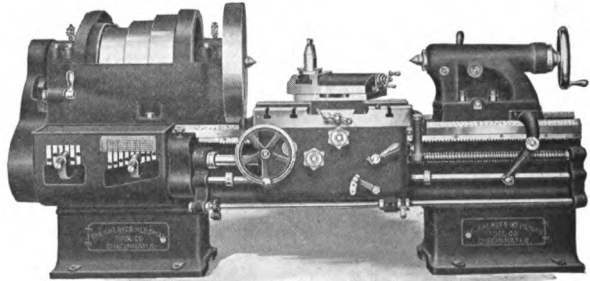
Manufacturers of Engine Lathes

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## THE G-K WAY:

The prime object in the design and construction of G-K Lathes is to give to their users a machine that will meet every requirement accurately, rapidly and give greatest convenience in operation.

This is accomplished by devoting our entire energy and equipment to the manufacturing of Engine Lathes. Our long experience in this line enables us to offer machines of the highest type and efficiency for the increasing demands of up-to-date shop practice.



20" Heavy Quick Change Three Step Cone Friction  
Double Back Gear Lathe

We build a complete line of Engine Lathes, from 14" to 30" inclusive. Our 14", 16" and 18" Lathes are built with **431** three styles of Headstock:

Four Step Cone Single Back Gear.

Three Step Cone Friction Double Back Gear.

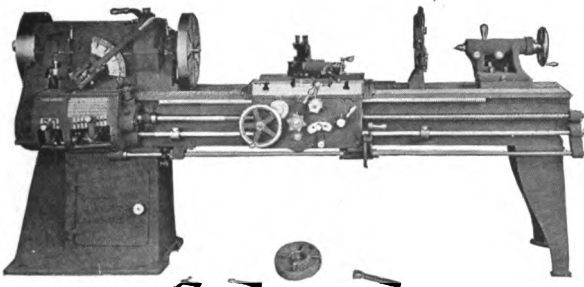
Geared Head, Single Pulley Drive.

Our 20", 24" and 30" Lathes are built in two styles:

Three Step Cone Friction Double Back Gear.

Geared Head, Single Pulley Drive.

All sizes of machines are built with Quick Change Mechanism.



16" Heavy Quick Change Geared Head Lathe

## THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO

Manufacturers of the Lodge and Shipley Manufacturing, Tool Room and  
Engine Lathes

### THE LODGE & SHIPLEY MANU- FACTURING LATHE:

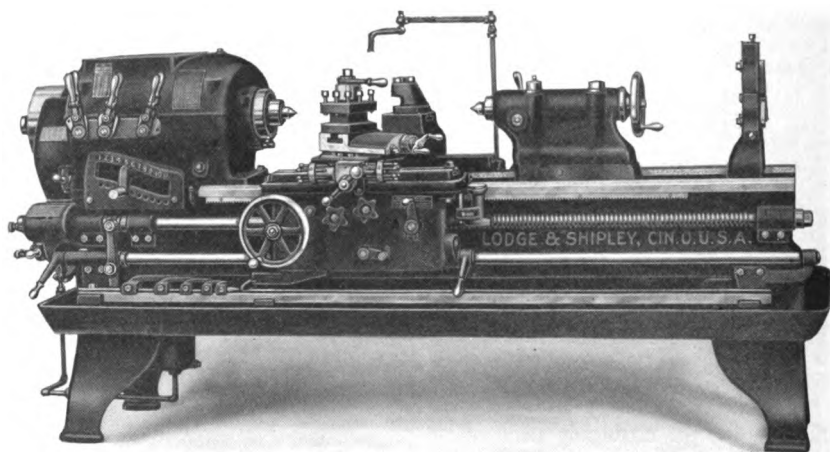
The fundamental purpose of the manufacturing lathe is time-saving. Through its use 25 to 50 per cent of the time usually taken in turning duplicate parts is saved. By placing diameters and lengths under control of positive stops not only is a great time-saving effected but frequently the duplication is more accurate than by hand measuring.

When not in use, the stops, which are located directly back of the cross feed handle, interfere in no way with the regular operation of the lathe.

Connected compound and plain rests provide conveniently located cutting tools. The tools on the front and rear rest may be set for roughing and finishing with one cut.

The four-way tool block gives immediate access to four tools. It fits the

432



Made in Sizes from 14" to 30"

Multiple length stops automatically throw out the carriage feed when the correct length has been reached. This is done by disengaging the clutch actuating the lead screw, which is also used as a feed rod. When a latch attached to the apron is lifted, the feed automatically re-engages for the next length.

Diameter stops are positive and accurate although not automatic. Their use eliminates the old cut-and-try methods.

T slot of either the compound or rear rest, as is also the case with the high duty tool block which is part of the regular equipment.

The pan arranged with pump and tubing catches the chips and lubricant and is built onto the lathe.

We will be pleased to send more detailed information. Our bulletin "Examples of Turning on the Manufacturing Lathe" is interesting. Write for it.

# THE HOUSTON, STANWOOD & GAMBLE COMPANY

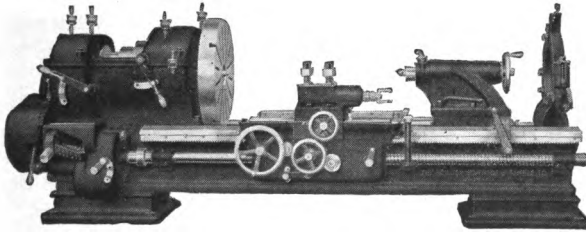
CINCINNATI, OHIO

Manufacturers of Heavy Duty Lathes

## HIGH POWERED ENGINE LATHES:

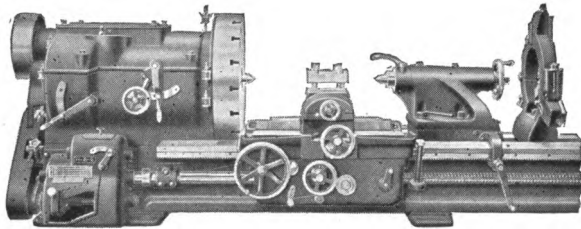
Extra Heavy Design in 36", 42", 48",  
54", 60" and 72" Swings.

STEEL gears throughout. Internal  
gear in face plate is steel FORGING.  
TOOTHED positive clutches for carriage  
feeds. Accurately built, large capacity,  
production tools.

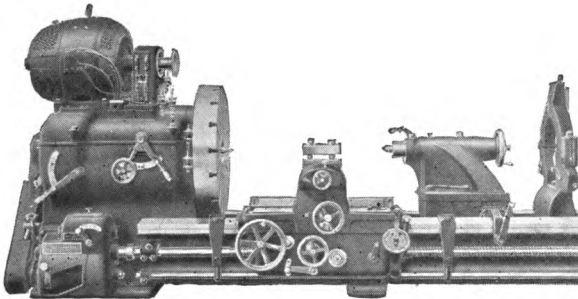


With  
Cone Drive

With  
Single Pulley  
Drive

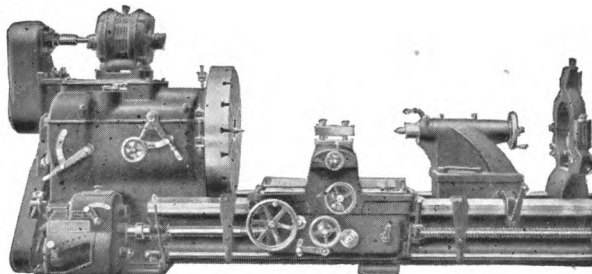


433



With  
D. C. Variable  
Speed Motor

With  
A. C. Constant  
Speed Motor



## INTERNATIONAL MACHINE TOOL COMPANY

1124 W. 21st Sr., INDIANAPOLIS, IND.

Manufacturers of the "Libby" Turret Lathes

### "LIBBY" TURRET LATHE:

At present we are offering two sizes, our 16-18" type "A" machine with  $3\frac{3}{8}$ " hole through the spindle and our 24-26" type "C" machine with either  $4\frac{1}{2}$ " or  $7\frac{1}{2}$ " hole through the spindle. The type "A" machine will swing 16" over the tool post carriage and 18" over the ways; the type "C" machine will swing 24" over the tool post carriage and 26" over the ways.

**Design is Right:** In designing, building and offering the "LIBBY" Lathe we have had in mind the following prime factors:

A line of heavy duty turret lathes capable of forming, facing, turning and

A machine with convenient power rapid traverse for each carriage, independent one of the other and of the feeds.

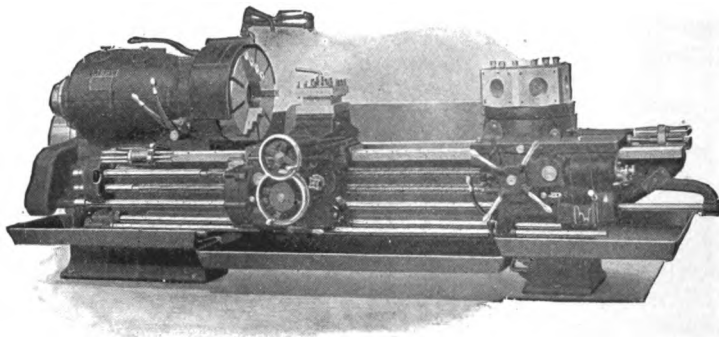
A machine with abundant power for pulling heavy extensive cuts.

A machine with abundant rigidity and stiffness to easily carry heavy strains and produce accurate work continuously.

A machine so convenient to handle and easy on the operator that there would be every incentive to keep the machine under cut a maximum percentage of the time and thus give a maximum production.

**We Claim for the "Libby" Lathe:** That the limit of its production is the limit of the ability of the cutting tools to stand up.

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boring chucked pieces up to 26" in diameter and bar work up to  $7\frac{1}{4}$ " in diameter.

An all-gear head machine with a single pulley drive.

A machine with a side carriage, permitting the full swing of the work.

A machine with flat ways so located as to receive, as nearly as possible, all the cutting strains on the flat ways.

A machine with the best relative number of feeds and speeds for maximum quantity and quality production.

A machine with all feeds for each carriage independent one of the other.

That it is adapted to successful, rapid, continuous service under the most severe conditions.

That it is at its best in heavy work—several broad faced or other cutting tools working at one time.

That on account of its strength, rigidity and stiffness it will produce work free from chatter with smooth, accurate finish.

That the control of the machine is so concentrated and the convenience for operation so great that men like to operate a "LIBBY" Lathe and consequently push production with a minimum of fatigue.

# INTERNATIONAL MACHINE TOOL COMPANY

## CONDENSED DATA ON "LIBBY" LATHES

	16-18" "A" Lathe	24-26" "C" Lathe 4½" Hole	24-26" "C" Lathe 7½" Hole
Swing over ways.....	18½ in.	26½ in.	26½ in.
Swing over carriage.....	17¼ in.	24 in.	24 in.
Travel of turret carriage.....	44 in.	72 in.	72 in.
Travel of tool post carriage.....	40 in.	72 in.	72 in.
Greatest boring depth capacity.....	13 in.	23 in.	23 in.
Hole in spindle.....	3⅞ in.	4½ in.	7½ in.
Three-jaw Universal chuck.....	16 in.	22 in.	22 in.
Front bronze bearing.....	4⅞ in. x 7⅞ in.	6½ in. x 8⅞ in.	9½ in. x 8⅞ in.
Rear bronze bearings.....	4½ in. x 5¼ in.	5¼ in. x 5½ in.	8¼ in. x 5½ in.
Drive pulley—diameter.....	18 in.	18 in.	18 in.
Countershaft speed.....	480	500	360
Width of belt.....	4 in.	8 in.	8 in.
Horse power of motor.....	10	20	20
Speed of motor (constant).....	1200	1200	1200
Speed of motor (variable).....	750 to 1600	750 to 1600	750 to 1600
Size of motor pulley at 1200	4½ in. x 7¼ in.	8½ in. x 7½ in.	8½ in. x 5½ in.
R. P. M.....	diam.	diam.	diam.
Width of front way.....	5½ in.	6 in.	6 in.
Width of back way.....	3½ in.	4½ in.	4½ in.
Turret slide bearing on ways.....	276 sq. in.	316 sq. in.	316 sq. in.
Tool post slide bearing on ways.....	141 sq. in.	144 sq. in.	144 sq. in.
Diameter turret base.....	12½ in.	16 in.	16 in.
Diameter of turret across flats.....	14 in.	18 in.	18 in.
Hole in turret bushed to.....	3¼ in.	4¼ in.	4¼ in.
Center of turret holes over ways.....	9 in.	12½ in.	12½ in.
Number of turret feeds.....	10	10	10
Range turret feeds.....	1/256 in. to ¼ in.	1/256 in. to ¼ in.	1/256 in. to ¼ in.
Diameter of tool post.....	7 in. sq.	9 in. sq.	9 in. sq.
Tool post feeds.....	6	6	6
Range of feeds.....	1/128 in. to ¼ in.	1/128 in. to ¼ in.	1/128 in. to ¼ in.
Power cross feeds.....	6	6	6
Range of cross feeds.....	1/128 in. to ¼ in.	1/128 in. to ¼ in.	1/128 in. to ¼ in.
Screw cutting change gears.....	7	7	7
Threads per inch.....	2 to 32	2 to 32	2 to 32
Number spindle speeds.....	8	8	8
Range spindle speeds.....	8 to 300	8 to 238	8 to 142
Gear ratios.....	1.87 to 1	2.1 to 1	2.53 to 1
	2.75 to 1	3.3 to 1	3.5 to 1
	5 to 1	5.6 to 1	6.7 to 1
	8 to 1	8.8 to 1	9.3 to 1
	13 to 1	14.9 to 1	12.2 to 1
	20 to 1	23.5 to 1	16.9 to 1
	38 to 1	40.1 to 1	32 to 1
Floor space.....	60 to 1	62.5 to 1	45 to 1
	60 in. x 138 in.	71 in. x 170 in.	71 in. x 170 in.
Radial sweep of bar.....	33 in.	57 in.	57 in.
Rapid traverse per minute.....	40 ft.	35 ft.	35 ft.
Net weight.....	7600	12000	13500
Shipping weight.....	8000	12600	14000
Shipping weight—export.....	9200	14000	15000
Space occupied—export.....	250 cu. ft.	390 cu. ft.	390 cu. ft.

## JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

503 MARKET STREET, SAN FRANCISCO, CAL.

109 QUEEN VICTORIA STREET, LONDON, E. C.

France, Spain and Belgium: F. Aubert & Co., 91 Rue de Maubeuge, Paris

Holland: Spliethoff, Beeuwkes & Co., Rotterdam

Japan, Korea, Etc.: Mitsui & Co., Ltd., Tokio

Australia and New Zealand, McPherson's Pty., Ltd., 554 Collins St., Melbourne

**Manufacturers of Flat and Turret Automatic Lathes**

### HARTNESS FLAT TURRET LATHES:

The Hartness Flat Turret Lathe with cross-sliding head is made in two sizes, and may be furnished with an equipment of tools for either bar work or chuck work, or a double equipment for both bar and chuck work.

The smaller machine is called the 2 x 24-inch, and when equipped with the automatic die outfit of tools it turns nearly every conceivable shape from the bar, up to  $2\frac{1}{4}$  inches diameter and 24 inches of length. On chuck work its capacity is  $12\frac{1}{2}$  inches diameter or less.

The 3 x 36-inch size handles bars of stock up to 3 inches in diameter, turning pieces up to 36 inches in length. It may also be equipped for chuck work up to  $14\frac{1}{2}$  inches in diameter.

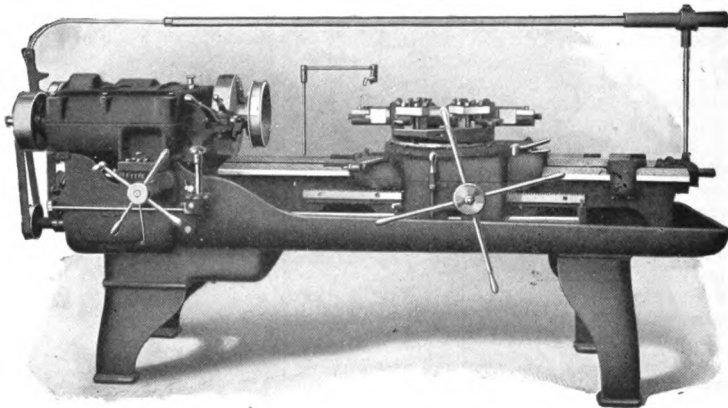
these features combined to set a new standard of output, accuracy and range of work in turret lathe practice.

The unique set of tools employed covered at one leap the evolution from the old-fashioned "screw machine" to the modern turret lathe. It enabled the turret lathe to practically displace the engine lathe on bar and stud work.

### The Cross-Sliding Head:

This feature, introduced in 1903, still further extended the field of the turret lathe, making it the standard machine for most chuck work of moderate size. The Cross-Sliding Head has three advantages: (1) It offers a cross-sliding

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### SPECIAL FEATURES:

#### The Original Flat Turret:

The Flat Turret was put on the market in 1891. Over thirteen thousand (13,000) machines equipped with them have been built and sold since, to the great satisfaction of the users. A large, steady tool clamping surface, a circular gib holding the turret down clear around its periphery, a locking pin directly under the cutting point of the tool—all

motion gibbed directly and securely to the bed. There is no piling of slide on slide, no narrow bearing foundation for a lofty superstructure of slide, tool holder and tool. The design is so stable that the piloted type of holder is seldom needed. (2) It permits the cross feed to be applied to every tool on the turret if necessary. (3) By allowing a cross adjustment to every tool, complicated and costly special tools are minimized. The regular outfit covers all regular work.

## JONES & LAMSON MACHINE CO.

### THE DOUBLE SPINDLE HARTNESS FLAT TURRET LATHE:

The special field of usefulness of the "Double-Spindle" Hartness Flat Turret Lathe is in machining moderate sized castings, forgings, and certain limited classes of bar work in large lots for quantity of production. In addition it may be used as a single-spindle machine of larger capacity, in which case it is adapted to small lot manufacture.

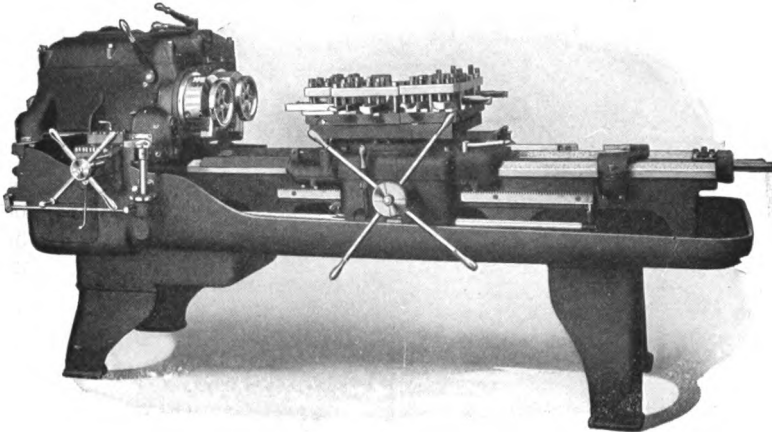
The machine has all the good qualities of the Single-Spindle Flat Turret Lathe which we introduced nearly a quarter

### SPECIFICATIONS:

**Working Range:** Swing over ways is 17 inches when used as a single-spindle machine, 10½ inches when both spindles are used. Cross travel of head is 10½ inches. Hole through spindle is 3¾ inches.

**The Cross-Sliding Head:** This is the only turret lathe in which the work-carrying headstock has a cross travel. This is indispensable on chuck work and is frequently convenient on bar work. It gives a cross feed for every tool without resorting to the frail double slide under the turret. Nine speeds in both directions from 20 to 298 revolutions per minute instantly obtainable. All gears run in oil bath.

**The Turret:** This is the original flat turret, 22 inches square, and is gibbed near outer edge. Index pin is located directly under working tool.



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century ago. With the expiration of the original patents, the flat turret has been adopted by other makers as the standard design for manufacturing work. But our later developments, like the cross-sliding head and the essential features of the double spindle, are of great mechanical and economic value to the manufacturer and are placed exclusively in these machines.

The double-spindle feature nearly doubles the output per operator and per machine.

Two spindles, two sets of tools, two pieces of work.

One turret, one machine, one operator, one set of motions.

On single-spindle work the corners of the turret can be used, giving eight positions in all.

**The Power Feed:** Both the carriage and the cross-sliding headstock are provided with power feed. It operates in both directions; has nine changes from 20 to 120 revolutions per inch of travel. These changes are instantly obtainable by sliding gears.

**Stops:** Each of the eight positions of turret is equipped with a separate stop, and there are four extra stops, making twelve in all. If desired, six stops can be used for one tool. The cross travel of the head is controlled by nine stops. Both sets of stops act in both directions and are placed as near as possible to the direct line of stress.

**Floor Space for Machine** is 5 x 10 feet. Approximate weight: net, 6600 pounds; crated, 6700 pounds; boxed for export, 7200 pounds. Cubic measurement, 240 cubic feet.



(Continued on next pages)

(Continued from preceding pages)

## JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

### THE FAY AUTOMATIC LATHE:

The Fay Automatic Lathe is a real lathe, with nine speed, all steel geared headstock, with three automatic speed changes, tailstock, carriage and bed. It differs from the engine lathe in the details of its mechanism, which fit it especially for the particular work it is designed to do. There is also the added mechanism required to make it automatic in all its motions.

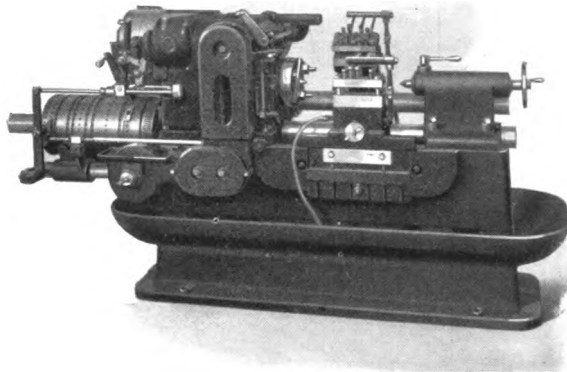
sand and one other pieces of the kind used in textile machinery, automobiles, machine tools, electrical work and machine building in general.

*Second operation work* is the legitimate field of the Fay Lathe.

Furthermore, it has a large field of usefulness in the accurate finishing of parts roughed out on other and less accurate automatic machines.

On the work described above the Fay Lathe will do straight turning, taper turning, form turning, straight facing, bevel facing, recessing, singly or in combination, with roughing or finishing cuts. It will do everything of this sort except threading, for which it is not adapted.

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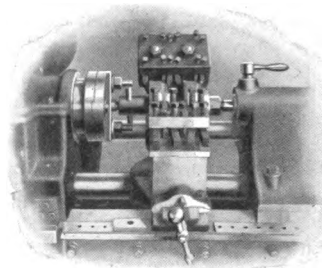


### Field:

The Fay Lathe is designed for the automatic turning of work held on centers. It is thus adapted to work which is itself centered, or to work which is mounted on an arbor.

In the class of *centered work* are included such standard parts as steering knuckles for automobiles, driving gears for transmission, forgings in general of such shape as to be turned rather than chucked, and many miscellaneous castings of the same type.

In the class of *work done on arbors* is included the large variety of parts which in ordinary practice is turned in the engine lathe by this means, as pulleys (either straight-faced or crowned), gear blanks, flanges, disks, hubs, and a thou-



Profitable Work for the Automatic Lathe

### Advantages of the Fay Automatic:

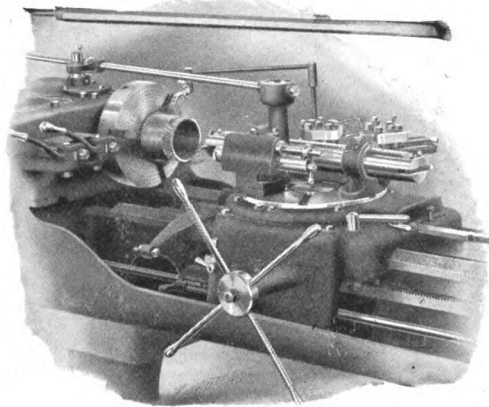
1. Ease of setting.
2. Rapidity of changing work.
3. Two pieces at a time.
4. Multiple tooling.
5. Taper turning and bevel facing.
6. Form turning.
7. Turned surfaces free from scoring on the return movement.
8. Flexibility of mechanism.
9. Facing and turning simultaneously.
10. One operator runs two machines.



## JONES & LAMSON MACHINE CO.

### AUTOMATIC CHASING ATTACHMENT:

The Hartness Chasing Attachment is shown applied to the Flat Turret Lathe.



This attachment is automatic. The carriage is locked to the bed and the attachment clutched with its positive drive from the work spindle. The threading tool feeds forward at cutting depth under lead screw control until the tool bar strikes a stop. The tool is then withdrawn to clear the work and returned at high speed to the starting point, where it is again fed in to cutting depth and engaged with the lead screw. The work spindle revolves continuously. The only motion required of the operator is that of adjusting the cross sliding head forward a slight amount during the return of the cutter to feed the tool in for the new cut. There is no possibility of over-running and gouging into a shoulder, no matter how fast the machine is run.

The advantage of this attachment is that it gives engine lathe accuracy to turret lathe threading—and it gives much more than engine lathe speed.

### HARTNESS AUTOMATIC DIE:

Wide Range      Few Dies

High Accuracy    Small Expense

No. 1 Die: Range for standard threads, from  $\frac{3}{16}$  inch to  $\frac{1}{8}$  inch diameter, any

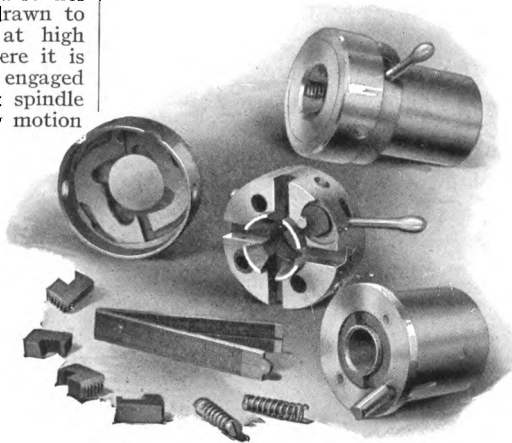
length. Particularly adapted for small hand or automatic screw machine work.

No. 4 Die: Range,  $\frac{1}{4}$  inch to  $1\frac{1}{4}$  inches diameter. This die is suitable for general turret lathe and screw machine use. It is especially adapted for use in automatic screw machines, owing to the compactness of its design.

No. 6 Die: Range,  $\frac{3}{4}$  inch to 2 inches diameter. This die is adapted for medium to large work on screw machines and turret lathes, and for the larger sizes of automatic screw machines.

No. 9 Die: Range,  $1\frac{1}{4}$  inches to 3 inches diameter. This die is designed for the heaviest turret lathe work. It is provided with six chasers, and has a special double roughing attachment which adapts it particularly to large diameters or coarse pitches.

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The No. 4 Hartness Automatic Die and Its Parts

Any of these dies, even the large No. 9, will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

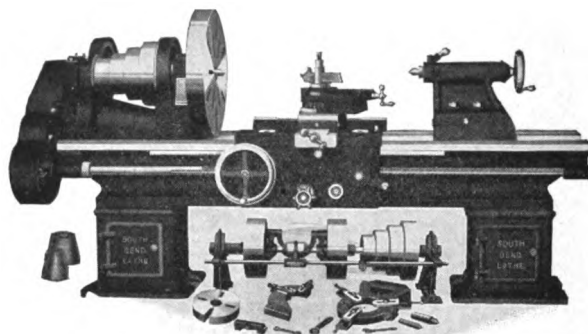
The lead-controlling feature is exclusive with this die. You can cut long threads as accurate in pitch as you will get from the ordinary engine lathe.

## **SOUTH BEND LATHE WORKS**

Established 1906

SOUTH BEND, INDIANA

Manufacturers of "South Bend" Engine Lathes



**No. 54-24" Lathe with Straight Bed**

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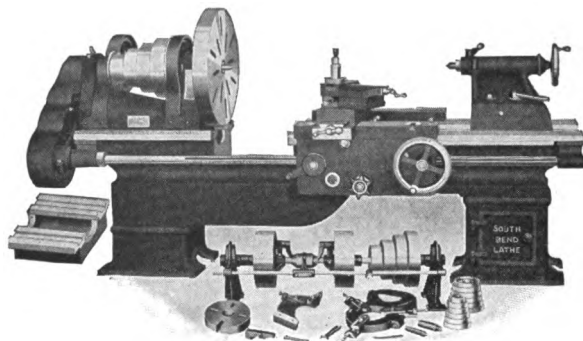
We have been making "South Bend" Lathes for 13 years. Over 20,000 in use.

South Bend Lathes are low in price because they are not equipped with expensive and unnecessary attachments.

"South Bend" Lathes are made in the

following sizes with both straight and gap beds:

13"	swing,	beds	4'	to	8'	in length.
15"	swing,	beds	5'	to	10'	in length.
16"	swing,	beds	6'	to	12'	in length.
18"	swing,	beds	6'	to	12'	in length.
21"	swing,	beds	7'	to	14'	in length.
24"	swing,	beds	8'	to	16'	in length.



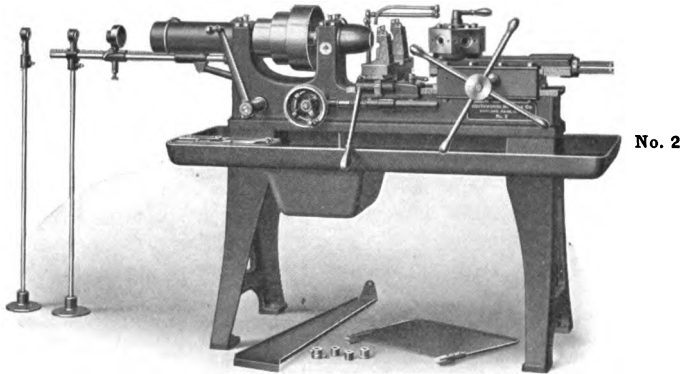
**No. 154-24" Lathe with Gap and Bridge**

## SOUTHWORTH MACHINE COMPANY

FACTORY  
PORTLAND, MAINE

NEW YORK OFFICE  
291 BROADWAY

Manufacturers of Geared Friction Head and Plain Head Hand Screw Machines



When you install a **Southworth Screw Machine**, you put into operation in your plant, a production tool, capable of uninterrupted work of the finest quality.

Numerous exclusive agencies in the United States and foreign countries are prepared to furnish Southworth Screw Machines from stock.

**Southworth Screw Machines** are built in three sizes, each one designed independently to perform its function in accordance with Southworth standards of Quality.

No. 1.—Plain Head, Automatic Chuck,  $\frac{5}{8}$ " Collet, Round Six Station Turret, Bar Feed, Lever Feed to Cut-Off. A neat, accurate, small machine.

No. 2.—Plain Head, Automatic Chuck, 1" Collet, Hexagon Turret, Bar Feed, Lever Feed to Cut-Off (Screw Feed optional), Hand Longitudinal Feed. A popular size, high production machine.

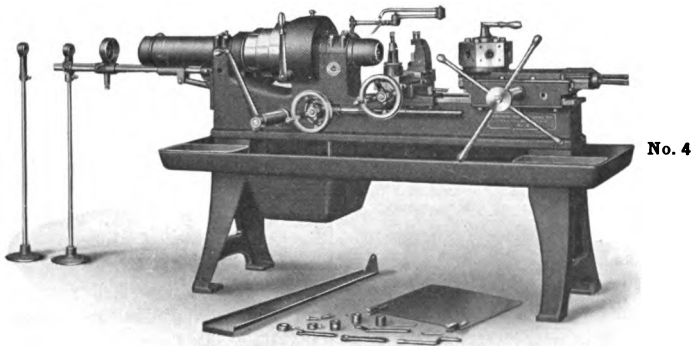
No. 4.—Geared Friction Head, Automatic Chuck,  $1\frac{1}{2}$ " Collet, Hexagon Turret, Bar Feed, Screw Feed to Cut-Off (Lever Feed optional), Hand Longitudinal Feed. Particularly designed for medium, heavy work in large quantity production.

All machines have these exclusive Southworth features: Positive Trouble-proof Turret Locking Pin Mechanism; Special designed Cut-Off with extra gibs; Feeds and Speeds in close geometric progression; Integral Lubricant Tank with Oversize Rotary Pump; Special Double Friction Countershaft, etc.

*Send for interesting literature and further details.*

—Remember—

**"SOUTHWORTH QUALITY"**



## STEINLE TURRET MACHINE CO.

MADISON, WISCONSIN

Originators of the Heavy Duty Full Swing Side Carriage Turret Lathe

### STEINLE 24" FULL SWING SIDE CARRIAGE TURRET LATHE:

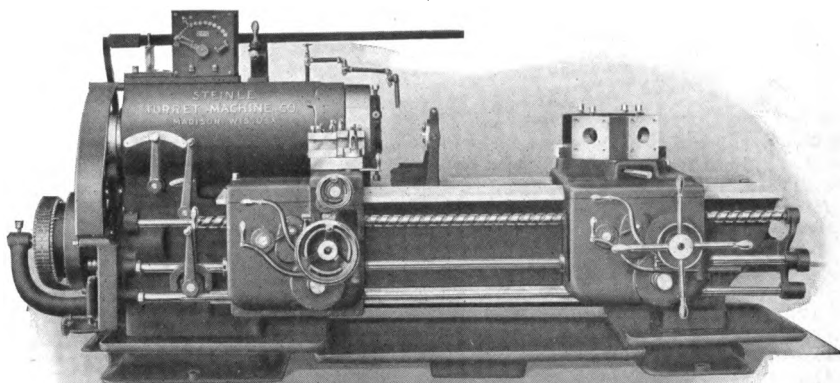
A modern high grade heavy duty turret lathe in the design of which particular attention has been given to strength and rigidity, power, the application and rigid support of proper tool equipment, labor and time saving features and convenience of operation.

There are thirty reversible spindle

duplicate in such large quantities that a battery of from thirty to forty machines is kept busy continually on one operation.

Manufacturers of gasoline engines, alcohol or distillate engines, steam engines or pumps in sizes of 20" cylinder bore, or smaller, for any class of service in either large or small quantities will find in this machine a great producer of such parts as pistons, cylinder heads,

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speeds available. One belt or one motor furnishes power for all functions of the machine.

Actual swing over ways, 24"

Swing over side carriage, 21"

Diameter of hole through spindle, 4" or 6 1/4"

Traverse of side carriage and of turret carriage, 56"

It will produce high quality work at low cost in either large or small quantities, being equally efficient where parts of a given kind and size to be made at one time are few in number, calling for frequent changing in the setting of tools, and where the parts are manufactured in

small cylinders where cast singly, fly wheels, eccentrics, one-piece piston rings, or bull rings, followers and rings, cross heads, bonnets, valves, glands, stuffing boxes or various other parts of valve gear.

Gear blanks made from iron or steel castings, forgings or bar stock, hubs for trucks or tractors, differential housings and many other parts too numerous to mention can be produced economically in this machine.

Send us drawings of your work and let us tell you all about this machine and what it will do for you. Production estimates gladly furnished.

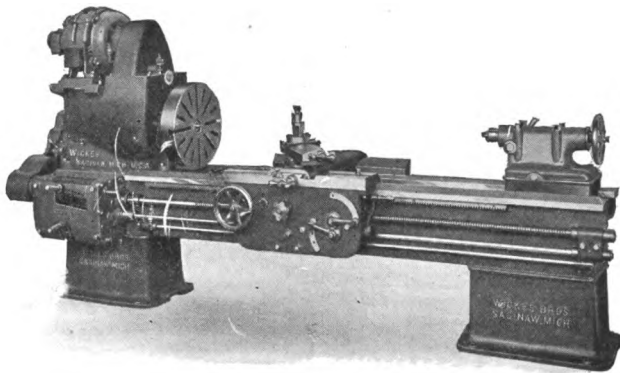
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## WICKES BROTHERS

SAGINAW, MICHIGAN

**Manufacturers of Heavy Duty Lathes**

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**20" Heavy Duty Motor Driven Engine Lathe**

**WE BUILD A COMPLETE LINE OF  
HEAVY DUTY LATHES, BELT AND  
MOTOR DRIVEN:**

20"-26"-32" and 36" Three Step Cone,  
double back geared, heavy duty.

24" and 30" Three Step Cone, double  
back geared, medium duty.

32"-42" and 48" Triple Back Geared.

17" Rapid Production Lathes, open  
belt or single back geared.

Complete line of Crank Pin Turning and  
Line Bearing Lathes for Crankshafts.

**HEAVY DUTY PLATE AND STRUC-  
TURAL WORKING TOOLS, CONSIST-  
ING OF:**

Bending Rolls—Vertical and Horizontal

Bending Rolls—Straightening

Bending Rolls—Angle

Punches —Vertical and Horizontal

Shears —Plate, Bar, Gate, Angle  
and Alligator

Drills —Radial, Wall or Counter-  
sinking

Flanging Clamps

Ask about the Wickes Continuous Elec-  
tric Blue Print System for making high  
grade blue prints.

*Ask for Catalogue.*

# THE WARNER & SWASEY COMPANY

CLEVELAND, OHIO

NEW YORK

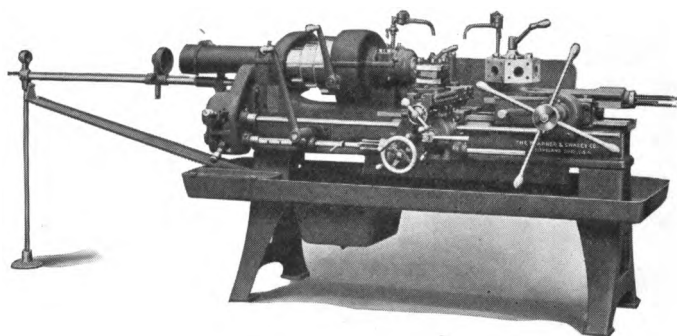
BOSTON

BUFFALO

DETROIT

CHICAGO

**Manufacturers of Turret Machinery**



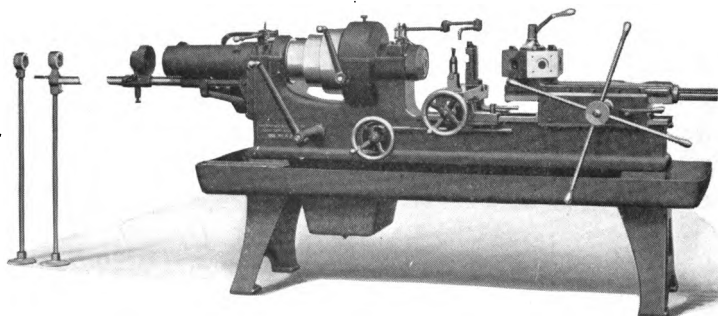
**No. 4 Universal Turret Screw Machine: Bar Equipment**  
Capacity:  $1\frac{1}{2}$ " x 10"; 16" swing

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## TURRET SCREW MACHINES:

Included in the five sizes is the No. 4 Universal, shown above, which takes two cuts at one time. Individual power-

operated feed shafts for carriage and turret saddle provide for simultaneous operation at the exact feed suited to each diameter, as with the Universal Hollow-Hexagon Turret Lathes.



**No. 6 Turret Screw Machine: Geared Friction Head**  
Capacity:  $2\frac{1}{4}$ " x 12";  $20\frac{3}{8}$ " swing  
Other Turret Screw Machines from  $\frac{3}{8}$ " capacity

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# THE WARNER & SWASEY COMPANY

CLEVELAND, OHIO

NEW YORK

BOSTON

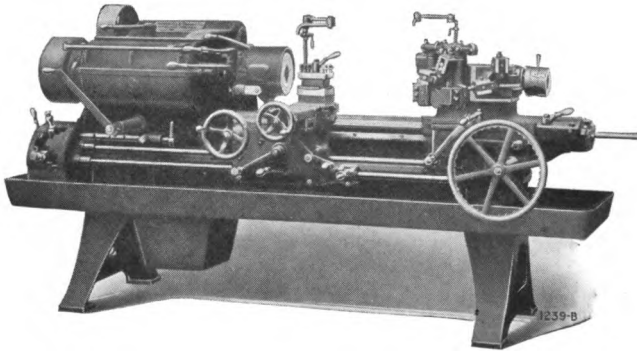
BUFFALO

DETROIT

CHICAGO

Manufacturers of Turret Machinery

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No. 2-A Universal Hollow-Hexagon Turret Lathe: Bar Equipment

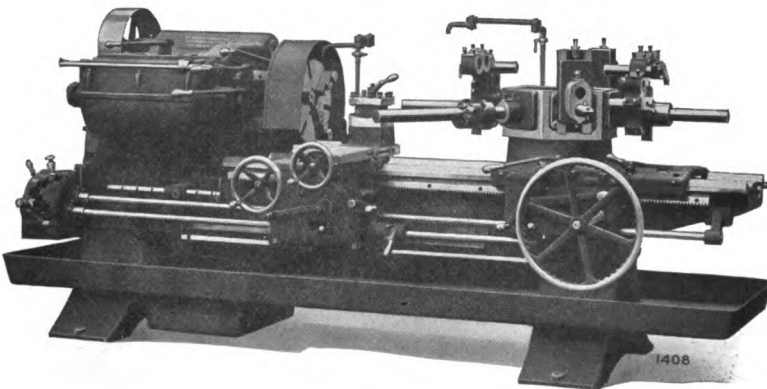
Two Capacities— $2\frac{1}{2}$ " x 29";  $16\frac{1}{2}$ " swing  
 $3\frac{1}{4}$ " x 29";  $16\frac{1}{2}$ " swing

## UNIVERSAL HOLLOW-HEXAGON TURRET LATHES:

These machines take two cuts at one time. By means of separate feed shafts for carriage and turret saddle, each with

ten individual feeds in either direction, the carriage will face, neck or form while the turret is drilling, reaming or turning. Each machine is equally adaptable to bar or chucking work.

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No. 3-A Universal Hollow-Hexagon Turret Lathe: Chucking Equipment

Two Capacities— $3\frac{1}{2}$ " x 44";  $21\frac{1}{2}$ " swing  
Two Capacities— $4\frac{1}{2}$ " x 44";  $21\frac{1}{2}$ " swing

# WOOD TURRET MACHINE CO.

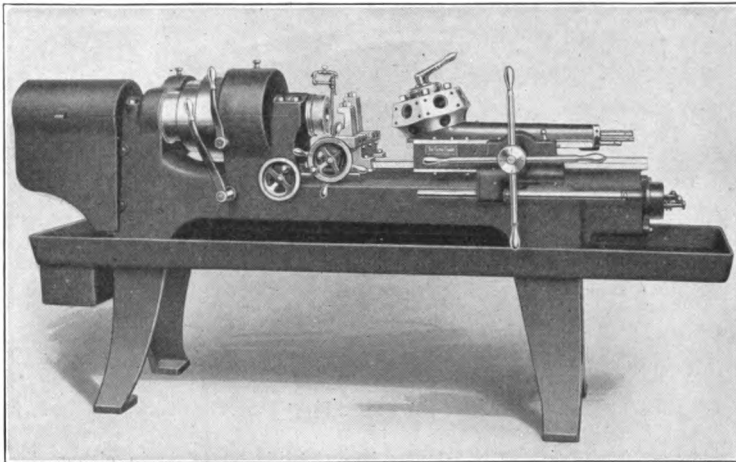
BRAZIL, INDIANA, U. S. A.

Manufacturers of the Tilted Turret Lathes and Screw Machines

**THE TILTED TURRET Screw Machines and Turret Lathes** constitute a line of strictly high grade machine tools which are the result of broad experience,

without changing the alignment of turret or spindle.

We specialize exclusively in manufacturing **THE TILTED TURRET**



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unexcelled facilities, together with a personnel of specialized mechanics.

Workmanship throughout is of the highest class. They are easy to operate, rigid in construction and will hold their accuracy indefinitely. Wearing parts are so constructed that they can be adjusted

screw machines, turret lathes and tools for manufacturing from a pin to a locomotive. Since the introduction of **THE TILTED TURRET**, it has had a steady increase in sales of duplicate orders. **FIFTEEN YEARS OF SATISFIED USERS. ASK THE USER.**

## THE TILTED TURRET, SEMI-AUTOMATIC, FRICTION-GEARED HEAD

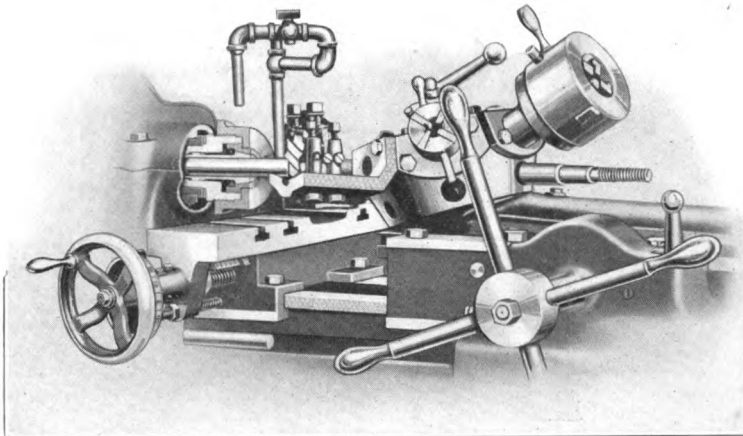
Number of Machine	No. 2 1"	No. 3 1 1/4"	No. 4 1 1/2"	No. 5 1 3/4"	No. 6 2"
Automatic chuck capacity	Prune	Plum	Robin	Thrush	Dove
Without power feed to turret slide	Quince	Peach	Sparrow	Eagle	Lark
With power feed to turret slide	1 1/8"	1 1/8"	1 7/8"	2 1/8"	2 1/8"
Dia. hole in spindle (auto. chuck removed)	1 1/8"	1 1/8"	1 7/8"	2 1/8"	2 1/8"
Dia. hole in auto. chuck plunger	1 1/8"	1 1/8"	1 7/8"	2 1/8"	2 1/8"
Diameter thread on spindle	3 3/8"	3 3/8"	3 3/8"	5 1/4"	5 1/4"
Pitch of thread on spindle	8 P	8 P	8 P	6 P	6 P
Swing over bed	13"	13"	13 1/4"	15"	15"
Largest diameter cone	12"	12"	12"	14"	14"
Width of belt	3"	3"	3"	3 1/2"	3 1/2"
Diameter of turret (across the flat)	6 1/2"	7 1/2"	7 1/2"	10 1/2"	10 1/2"
Diameter of holes in turret	1 1/2"	1 1/2"	1 1/2"	1 3/4"	2"
Holes in turret to top of slide	3 1/2"	3 1/2"	4"	4"	4 1/2"
Effective motion to slide	10"	10"	10"	12"	12"
Max. dist. end of spindle to face of turret	16"	18"	18"	30"	30"
Friction pulleys on countershaft	10"x3 3/4"	10"x4 1/4"	12"x4 1/4"	14"x4 7/8"	14"x4 7/8"
Countershaft speed	325	300	250	225	200
Floor space	36"x96"	36"x102"	40"x102"	44"x128"	44"x132"
Wt., crated, for dom. shipment, about	2170	2440	2540	3830	4030
Wt., boxed, for for'n shipment, about	2545	2815	2915	4495	4725
Bulk, boxed, for for'n shipment, about	102 cu. ft.	102 cu. ft.	102 cu. ft.	190 cu. ft.	190 cu. ft.
With Automatic Chuck But Without Bar Feed					
Without power feed to turret slide	Raisin	Willow	Swallow	Oriole	Gull
With power feed to turret slide	Elm	Oak	Owl	Quail	Raven
Without Automatic Chuck and Bar Feed					
Without power feed to turret slide	Poplar	Maple	Crow	Canary	Magpie
With power feed to turret slide	Pine	Walnut	Hawk	Wren	Buzzard



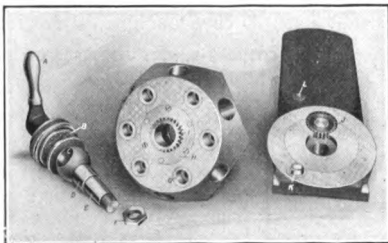
# WOOD TURRET MACHINE CO.

## THE TILTED TURRET, SEMI-AUTOMATIC WITH PLAIN HEAD

Number of Machine.....	No. 1	No. 2	No. 3
Automatic chuck capacity.....	3/4"	1"	1 1/4"
Diameter hole in spindle (auto. chuck removed).....	1 1/8"	1 3/8"	1 5/8"
Diameter hole in auto. chuck plunger.....	1 1/8"	1 1/8"	1 3/8"
Diameter thread on spindle.....	3"	3 3/8"	3 3/8"
Pitch of thread on spindle.....	8 P	8 P	8 P
Swing over bed.....	11"	13"	13"
Large diameter cone.....	9"	11"	12"
Width of belt.....	2 1/2"	3"	3 1/2"
Diameter of turret (across the flat).....	5 1/2"	7 1/4"	7 3/4"
Diameter of holes in turret.....	7/8"	1"	1 1/4"
Center of holes in turret to top of slide.....	2 5/8"	3 1/2"	3 1/2"
Effective motion to slide.....	6"	10"	10 1/2"
Max. dist. end of spindle to face of turret (hand feed machine).....	12"	16"	16"
Friction pulleys on countershaft.....	10"x3 1/4"	10"x3 3/4"	12"x4 1/4"
Countershaft speed.....	250	225	200
Floor space.....	67 1/2"x27"	73"x28"	76"x28"
Weight, crated, domestic shipment, about.....	1275 lb.	2034 lb.	2204 lb.
Weight, boxed, foreign shipment, about.....	1700 lb.	2358 lb.	2528 lb.
Bulk, boxed, about.....	69 cu. ft.	86 cu. ft.	86 cu. ft.
Code word.....	Apple	Banana	Barberry
Without power feed to turret slide.....		Baneberry	Bayberry
With power feed to turret slide.....			
With auto. chuck, without bar feed.....	Apricot		
Without power feed to turret slide.....		Bilberry	Bean
With power feed to turret slide.....		Cucumber	Beet
Without auto. chuck and bar feed.....			
Without power feed to turret slide.....	Blueberry	Cherry	Chickpea
With power feed to turret slide.....		Chesty	Citron



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Can a turret lathe or screw machine be designed and manufactured so as to be a precision machine and retain this accuracy under the present-day demand for maximum production?

Send for *The Tilted Turret Lathe and Screw Machine Encyclopedia*, and decide for yourself.

## THE CLEVELAND AUTOMATIC MACHINE COMPANY

CLEVELAND, OHIO

Manufacturers of Automatic Machines

### "CLEVELAND" AUTOMATIC MODEL "A" MACHINE:

With Spindle Capacity for  $7\frac{3}{4}$ " Bar.

We build the style of machine illustrated on this page in four sizes.

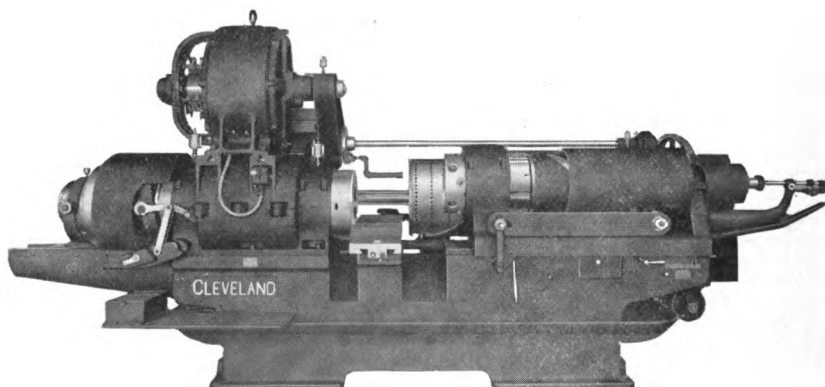
The motor is a direct current 15 H. P. machine with a speed range of from 300 to 1200 R. P. M. and is connected by a Link Belt Silent Chain and helical gearing to the main spindle and also to the feed driving mechanism.

The motor is protected by means of automatic accelerators and overload relay,

and when cutting off, the speed of the bar is accelerated as the tool approaches the center.

The correct feed per revolution for each individual tool is obtained by an easy adjustment, and as the speed of the feed driving mechanism varies with the spindle speed, the feed per revolution remains constant. The eight spindle speeds are controlled by a patented control box, by means of which any of the speeds are automatically selected to suit each tool.

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Variable Speed Motor-Driven

mounted on a panel in the rear of the machine, and starting and stopping is accomplished by means of a push button on the front of the machine within easy reach of the operator.

There are eight different spindle speeds, from 40 to 160 revolutions. The correct cutting speed for different diameters of bars on different kinds of steel are available as each cutting tool comes into play,

There is a small constant speed motor which drives the oil pump independent of the rest of the machine, delivering oil under a constant pressure, regardless of the speed at which the machine may be running.

The four sizes mentioned can be purchased with or without motor.

*Send for illustrated literature.*

## THE NEW BRITAIN MACHINE CO.

NEW BRITAIN, CONN.

Manufacturers of Automatic Screw and Chucking Machines

### MULTIPLE-SPINDLE AUTOMATIC CHUCKING MACHINES:

#### Single- and Double-Head Types

Designed for finishing castings, forgings, and second operations on screw-machine products. All operations performed simultaneously and automatically, the time required to complete a piece involving a series of operations being only that of the longest single operation or subdivision thereof. Productions three to five times those of the turret lathe or hand screw machine.

### MULTIPLE-SPINDLE AUTOMATIC CHUCKING MACHINE:

#### Work-Rotating Type

Adapted for handling certain classes of work formerly done on machine illustrated above—but with greater efficiency. Work is rotated, enabling use of both end and cross slide tools simultaneously. Air pressure is used to stop and start the spindle and to release and grip the work, thus relieving the operator from the labor of hand chucking-up and constant clutching of spindle.

### SIX-SPINDLE AUTOMATIC SCREW MACHINE:

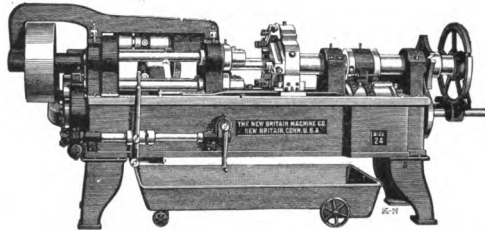
For producing parts from bar stock. Fully automatic. Its six spindles make rehandling of complicated work unnecessary and greatly increase production on simple work by the subdivision of the longer operations.

Sizes  $\frac{3}{8}$ ", 1",  $1\frac{1}{8}$ " and  $2\frac{1}{2}$ ".

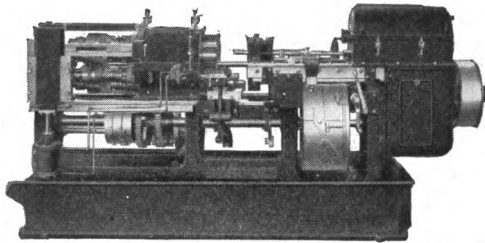
### SEXTUPLE AUTOMATIC BAR MACHINE:

For blanking rolls, sleeves, pipe couplings, studs, nuts, etc., from bar stock. Six spindles. Fully automatic. Designed to feed, drill, face, turn, chamfer, and cut off in all six positions, making possible productions nearly six-fold those of a single-spindle automatic.

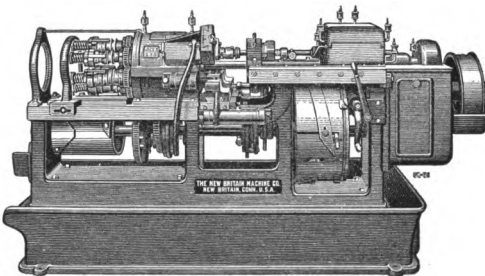
*Production estimates  
gladly submitted.*



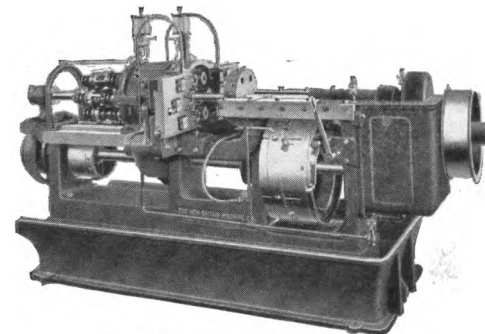
Multiple-Spindle Automatic Chucking Machine  
Single-Head Type



Multiple-Spindle Automatic Chucking Machine  
Work-Rotating Type



Six-Spindle Automatic Screw Machine



Sextuple Automatic Bar Machine

## THE NATIONAL ACME COMPANY

CLEVELAND, OHIO, U. S. A.

NEW YORK

BOSTON

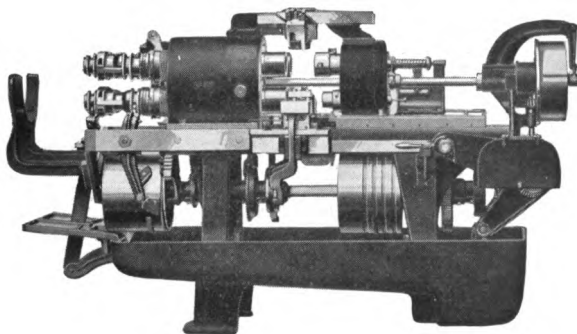
CHICAGO

DETROIT

**Screw Machinery, Screw Machine Products, Dies and Taps**

### ACME MULTIPLE SPINDLE AUTOMATIC SCREW MACHINES:

Automatic producers of duplicate parts from Brass, Iron and Steel bars, in sizes up to 3  $\frac{3}{4}$ " diameter, 12" long.



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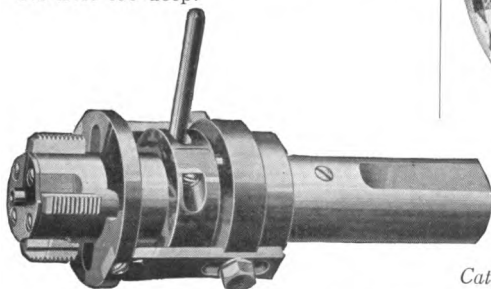
**Acme Multiple Spindle Automatic Screw Machine**

Secondary operations are reduced to a minimum by the use of tools for shaving, cross drilling, end and side milling, etc.

Furnished with Single Belt or Motor Drive.

### NAMCO AUTOMATIC COLLAPSING TAPS:

Have positive collapsing chasers fully supported back of the cutting edge; simplicity of construction and few adjustments; wide range of work as chaser diameter is largest diameter on tap. "No hole too deep."



**Namco Automatic Collapsing Tap**

### NAMCO AUXILIARY SCREW MACHINES:

Of fully automatic and semi-automatic types are built as follows:

Stud Threaders    Bolt Threaders

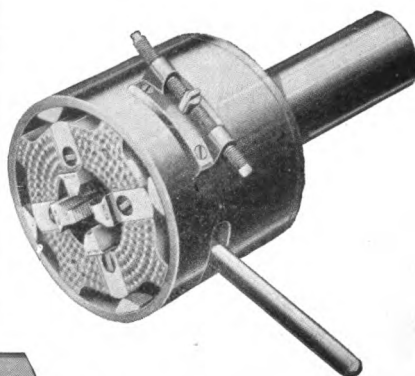
Single and Multiple Spindle Drilling Machines.

Screw Head Slotting Machines all are highly specialized for secondary operations.

Tool and Chaser Grinders.

### NAMCO AUTOMATIC THREADING DIES:

For every threading requirement include Self-Opening Dies for Hand Machines; Self-Opening and Self-Closing Die Heads for Automatic Screw Machines, Bolt Threaders, etc.; Adjustable Chaser Dies for heavy work; Adjustable Spring Dies.



**Namco Automatic Threading Die**

*Catalogs on any of the above sent on request.  
Quotations made on samples or blue prints.*

# THE NATIONAL ACME COMPANY

(Successors to Windsor Machine Co.)

WINDSOR, VERMONT

NEW YORK

BOSTON

CHICAGO

DETROIT

## GRIDLEY MULTIPLE AND SINGLE SPINDLE AUTOMATIC SCREW MACHINES:

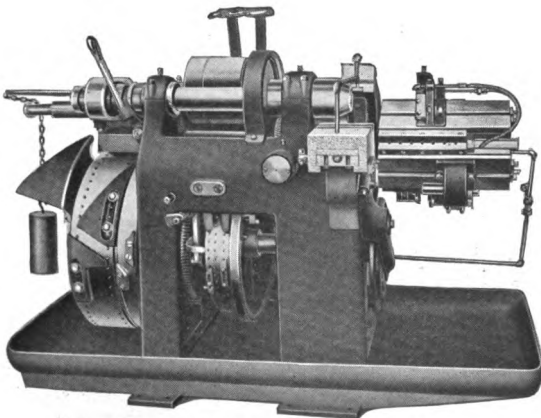
Gridley Single and Multiple Spindle Screw Machines are fully automatic and are designed for making duplicate parts from bar stock, steel or brass.

Extreme accuracy is obtained by the rigid frame design and method of holding tools close up to their cutting points.

The simplicity of setups permits an exceptionally wide range of tooling, while the possible tool combinations reduce secondary operations to a minimum.

The Gridley Single completes, automatically, work usually accomplished on turret lathes, in sizes up to 5" diameter, while the Multiple Spindle finishes the small duplicate parts up to  $2\frac{5}{8}$ " diameter.

Both types are furnished with either Belt or Motor Drive.

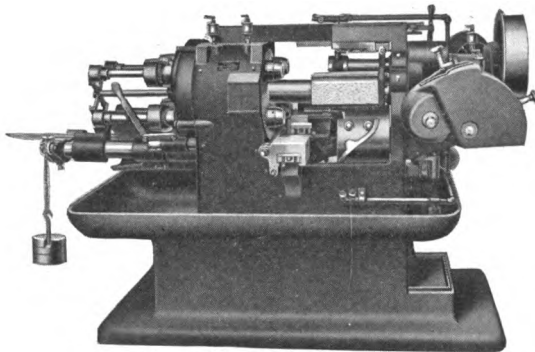


The Gridley Single Spindle Automatic

## THE GRIDLEY MULTIPLE SPINDLE AUTOMATIC:

is built in four sizes—

$\frac{3}{4}$ "— $1\frac{1}{4}$ "— $1\frac{3}{4}$ "— $2\frac{1}{4}$ ", and handles work up to 7" in length.



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The Gridley Multiple Spindle Automatic

## THE GRIDLEY SINGLE SPINDLE AUTOMATIC:

is built in four sizes—

$2\frac{1}{4}$ "

$3\frac{1}{4}$ "

$4\frac{1}{4}$ "

5"

and handles work up to 12" in length.

*Complete descriptions on request.*

*Catalogs or bulletins.*

# THE BULLARD MACHINE TOOL CO.

BRIDGEPORT, CONN., U. S. A.

**BULLARD**

## VERTICAL TURRET LATHE:

**Sizes:** The Bullard Vertical Turret Lathe is made in 4 sizes—24-inch, 36-inch, 42-inch and 54-inch. General specifications of these machines given below.

Machine.....	24"	36"	42"	54"
Capacity—				
Diameter.....	26"	38"	44"	56"
Under Crossrail...	20"	24"	33"	38"
Under Tur. Face...	28½"	35"	43½"	49"
Table Diameter....	24¼"	34"	42¾"	50"
Table Speeds.....	8	12	12	12
Feed Changes—				
Both Heads.....	8	8	8	8
Main Head—				
Vert. Movement..	18"	26"	27"	27"
Will Face.....	26"	38"	44"	56"
Main Turret—				
Diameter.....	14"	15¼"	16¾"	16¾"
Side Head—				
Vert. Movement..	18"	19"	28"	31"
Horiz. Movement.	11½"	20"	21"	21"
Weight—Net.....	8500	14000	18500	23000
Motor.....	7½ hp.	10 hp.	15 hp.	15 hp.

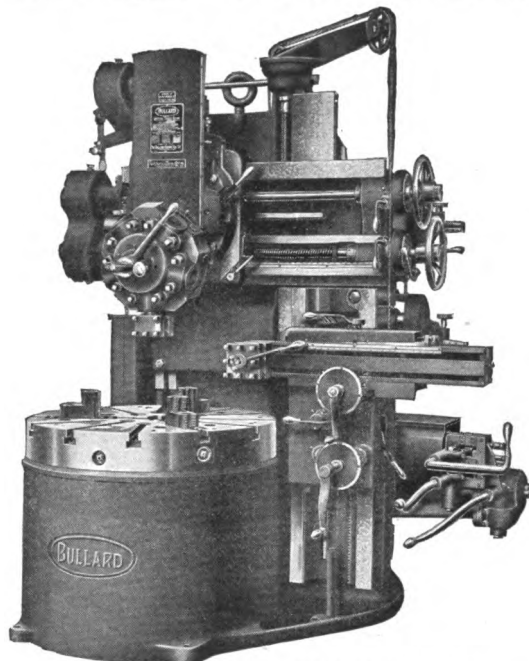
**Adaptability:** Widely adaptable and

Two tool heads, one main and one side, are universal in their movement and adjustment throughout the entire range of the machine, thus simplifying the tool equipment required for a wide range and variety of work: the same tools, excepting reamers, etc., are equally adaptable to the smallest and largest pieces of the same class.

By means of accurately graduated scales and micrometer dials, and adjustable "Observation Stops" mounted thereon, tools are readily set and sizes obtained and maintained.

Convenient, certain and positive control, without complication, with each unit developed for the maximum service required thereof, and with a due and intelligent regard for the completed whole, results in quality intensive production.

Our book "Cutting Time between Cuts" tells the story in a general way. For detailed information on your work,



Vertical Turret Lathe—Sizes, 24, 36, 42 and 54 Inches

extremely durable, the Bullard Vertical Turret Lathe may be kept in continuous operation—producing.

we place at your command the services of our Engineering Department. No obligation.

# THE BULLARD MACHINE TOOL CO.

## THE BULLARD MAXI-MILL:

### Sizes:

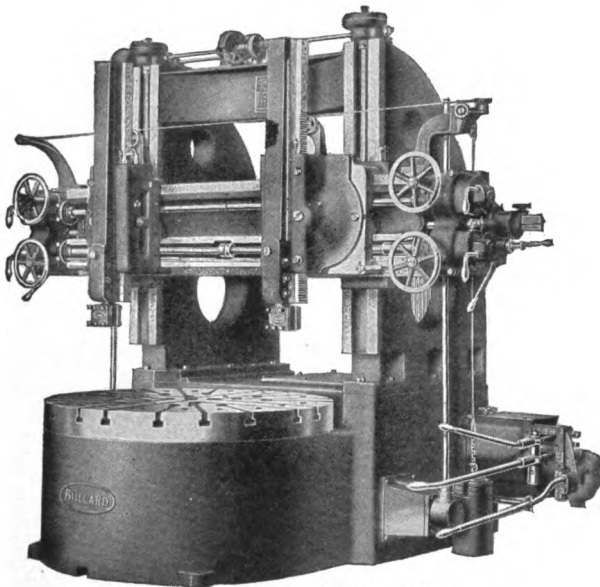
The Bullard Maxi-Mill is made in three sizes—44-inch, 54-inch and 61-inch.

The general specifications of these machines are given below.

Machine.....	44"	54"	61"
Capacity—Diameter.....	48"	56"	63"
Under Crossrail.....	34"	43"	52"
Under Toolholders.....	34"	43"	52"
Table Diameter.....	42 $\frac{3}{8}$ "	50"	61"
Table Speeds.....	12	12	12
Feed Changes—			
Both Heads.....	8	8	8
Tool Slides—			
Vertical Movement.....	36"	36"	36"
Weight—Net.....	20000	23000	28000
Motor Drive.....	15 hp.	15 hp.	15 hp.

and materials of construction this machine is purposed to withstand the most severe usage continuously with a minimum of maintenance cost.

Like the Bullard Vertical Turret Lathe, it is equipped with certain, positive and convenient control, hammer hand wheels, continuous flow lubrication, graduated scales, micrometer dials, observation stops for the duplication of sizes and the table may be started and stopped from either side of the machine.



Maxi-Mill—Sizes, 44, 54 and 61 Inches

### Adaptability:

This machine represents the maximum possibilities of the Vertical Boring and Turning Mill based upon a knowledge of the requirements gained by extensive observation and a specialized experience as makers and users thereof. In design

For production data on this machine, consult our Engineering Department, the services of which are at your command without obligation.



(Continued on next page)

(Continued from preceding pages)

## THE BULLARD MACHINE TOOL CO.

BRIDGEPORT, CONN., U. S. A.

### THE BULLARD MULT-AU-MATIC:

#### 8-Inch and 12-Inch

In comparison with any other method of producing an equivalent output of similar work, the Bullard Mult-Au-Matic

WILL SAVE  $\frac{1}{6}$  to  $\frac{9}{10}$  in labor cost

BECAUSE men, in proportion, are released for other work.

WILL SAVE  $\frac{1}{6}$  to  $\frac{9}{10}$  in floor space

BECAUSE it is six machines in one, automatically and mechanically coordinated—and vertical.

WILL SAVE  $\frac{2}{3}$  to  $\frac{3}{4}$  in tool equipment

BECAUSE it requires but one simple set for the six machines combined in one—and these may be conserved by timing all operations, long or short, to complete simultaneously.

WILL SAVE in original investment

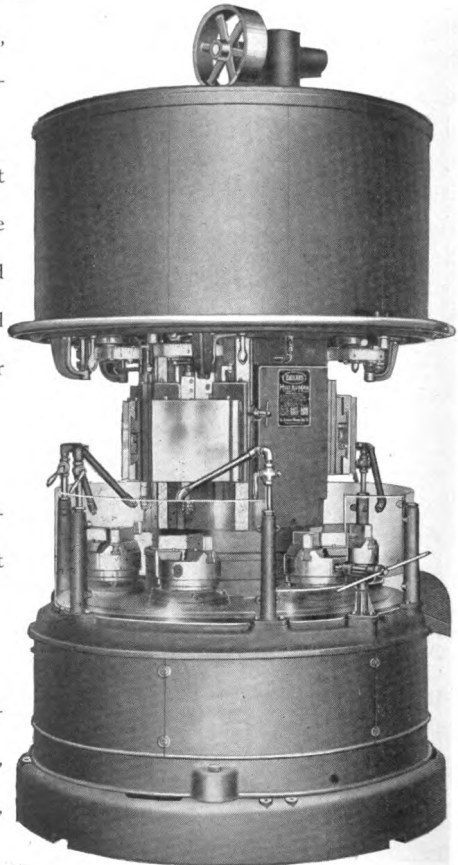
BECAUSE floor space, other machines, tools and related equipment for equal output cost more.

WILL SAVE overhead expense

BECAUSE it requires less investment, less floor space, fewer men, less power, smaller tool renewal, and lower maintenance charges.

The preceding statements are based on actual performance. Let us prove them on *your* work. The services of our Engineering Department are at your command, without obligation.

**BULLARD**





# T. C. DILL MACHINE COMPANY, INC.

PHILADELPHIA, PA., U. S. A.

Builders of Slotters

## THE "DILL SLOTTER."

In the design of the "Dill Slotter," to meet the demands of today, it was plain that a departure was necessary and that procedure must be in at least two directions: First, that the machine must be able to produce a greater amount of work and that work must be more accurate. Second, that it must have a much greater range and not be confined only to the ordinary slotter work, but also reach out into other fields of usefulness; and, besides all this, it must be, if possible, more durable. The following features, which for the most part are exclusive, show how this Slotter meets the above requirements.

The GENERAL CONSTRUCTION of the "Dill Slotter" throughout is such as to insure efficiency and durability. It is constructed of the best material for the purpose; the gears are all cut from solid metal and mostly of forged steel; flat bearing surfaces are all hand-scraped to surface plates and are of ample dimensions. Gears, shafts, etc., are readily accessible for inspection. The convenience of operation is of special merit; while it is operative from one point principally, hand feeds are provided on all sides.

## Attributes:

**A Traveling Head**—Greatly increases the range of the machine.

**A Quick Traverse Gear**—A great time and labor saver.

**New Quick Return**—Permits high and uniform cutting speeds.

**New Intermittent Feed**—For feeding heavy work at high speeds.

**An Automatic Knock-Off**—A safety device for the feed mechanism.

**A Stroke Indicator**—Quite indispensable; nothing like it.

**A Hand Wheel Controller**—A good thing, and in the right place.

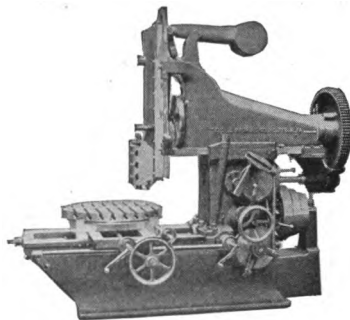
**A Tool Post in the Relief Apron**—Very handy in changing tools.

**Six Changes of Speed**—About four is the usual number.

**Belt and Motor Driven**—Designed for both; not a make-shift.

**Powerfully Geared**—About double the usual ratio.

15 Inch Slotter. Belt or Motor Driven



Arranged for Belt Drive

## PRINCIPAL DIMENSIONS

Size of machine, in.....	10	10-12	15	15-18	20	20-24
Maximum stroke, in.....	10½	12½	15½	18½	21	25
Longitudinal movement of table, in.....	28	28	36	36	48	48
Transverse movement of table, in.....	20	20	30	30	40	40
Diameter of table, in.....	24	24	34	34	44	44
Movement of head, in.....	15	15	20	20	30	30
From table to head, in.....	12	12	19¼	19¼	24½	24½
Adjustment of ram, in.....	16	16	23	23	32	32
Will cut to the center of circle of.....	54 in.	54 in.	72 in.	72 in.	92 in.	92 in.
Will cut to outside of circle of.....	54 in.	54 in.	90 in.	90 in.	108 in.	108 in.
Strokes of ram per minute, r. p. m.....	11½-85	10-76	8-48	7-43	6-31	5½-27
Feed of table per stroke, in.....	0.011	0.011	0.010	0.010	0.0069	0.0069
Circular feed per stroke at 12 in. dia. (in.).....	to 0.154	to 0.154	to 0.187	to 0.187	to 0.138	to 0.138
Feed of head per stroke, in.....	0.0187	0.0187	0.011	0.011	0.0055	0.0055
Ratio of gears from cone pulley shaft.....	to 0.261	to 0.261	to 0.196	to 0.196	to 0.11	to 0.11
Size of countershaft pulley, in.....	0.0055	0.0055	0.005	0.005	0.00345	0.00345
Speed of countershaft, r. p. m.....	to 0.077	to 0.077	to 0.093	to 0.093	to 0.069	to 0.069
Horsepower of motor.....	12 to 1	12 to 1	18 to 1	18 to 1	24 to 1	24 to 1
Speed of constant speed motor, r. p. m.....	14 x 3½	14 x 3½	20 x 4	20 x 4	26 x 5	26 x 5
Speed of adjustable speed motor, r. p. m.....	200	180	200	180	200	180
Net weight, lbs.....	3	3	5	5	10	10
Code word.....	1,200	1,000	1,200	1,000	1,200	1,000
	400 to	400 to	400 to	400 to	400 to	400 to
	1,200	1,200	1,200	1,200	1,200	1,200
	5,750	6,000	11,000	11,500	25,000	26,000
	Ummoj	Ummuk	Ummyl	Umnag	Umnch	Umnij

## THE CINCINNATI PLANER CO.

OAKLEY, CINCINNATI, OHIO

Manufacturers of Planers and Boring Mills

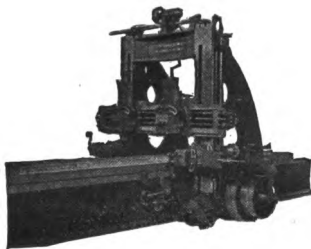
### CINCINNATI PLANERS:

In these days of advanced methods for greater production the three principal elements entered into are Variable Cutting Speeds, the rapid and easy manipulation of all parts, and rigidity in design to withstand the strains imposed by high cutting speeds.

Cincinnati Planers are designed for speed variation, power, rigidity, durability, convenience in operation and adaptability for all classes of work required of a planer.

**Standard and Heavy Pattern Planers** are made in all sizes from 22" to 96". The beds are of a heavy deep box section

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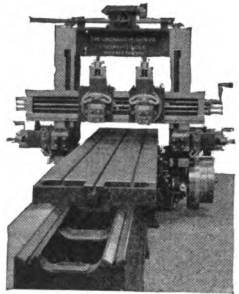


Standard Planer

and are strengthened where the gearing and uprights are mounted. The tables are of unusual thickness and are braced at short intervals with heavy ribs, thus preventing any possibility of springing under the heaviest work. Cross rails are of great depth, and have an extra deep box brace on the back. The heads are distinctive, the end of tool blocks and slides being made round. The gearing and rack are of extra wide face—all the large gears and racks are made from semi-steel castings and the pinions from steel forgings.

**Widened Planers:** There is a great variety of planing on woodworking machinery, electrical machinery, printing presses, agricultural implements, etc., which does not require a standard machine, and these manufacturers are rapidly recognizing the advantage of the Widened

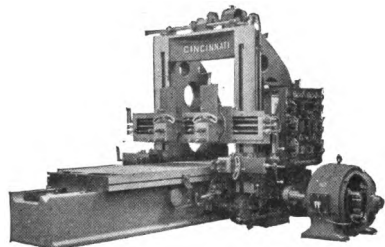
Planer. In a great many cases a 36" planer widened to 48" will do the job, and do it quicker than the 48" Standard machine, as it is easier to handle and capable of higher speeds. We build these planers to suit your work, and have patterns for the various sizes given below.



Widened Planer

SIZES: 36" x 28", 36" x 30", 42" x 36", 48" x 36", 56" x 42", 60" x 48", 72" x 56", 84" x 72", 96" x 72", 120" x 96", 134" x 96".

**Variable Speeds:** The greatest possible gain in planing comes from access to a change of cutting speeds. A correct speed for all materials and conditions, instantly available, is the secret of economy in planing.



Reversible Motor Driven Planer

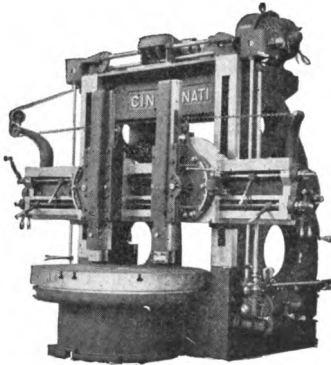
All Cincinnati Planers from 22 to 48 inches inclusive are regularly furnished with our patent Tu-Speed Drive, giving two cutting speeds and a constant return. Where a greater number of speeds are needed our Reversible motor drive, Non-reversible motor drive or Speed Box drive is furnished. The Reversible and Non-reversible motor drives for direct current and the Speed Box for alternating current.

**Motor Drive:** All Cincinnati Planers may be arranged for motor drive.

# THE CINCINNATI PLANER CO.

## CINCINNATI BORING MILLS:

**Bevel Gear Type:** Made in 4 ft., 5 ft., 6 ft. and 7 ft. Massive Type.



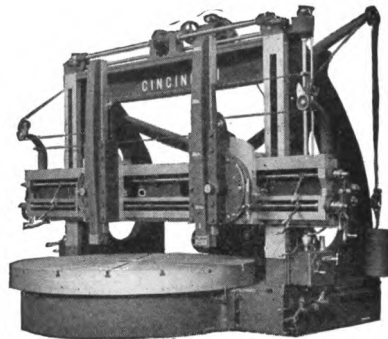
Rapid Production Boring Mill

**GENERAL DESCRIPTION:** *Capacity.* These rapid production Mills have a capacity of two inches over the rated size. *The table* is large in diameter and rigidly constructed. *The bed* is deep and heavily ribbed; it has a box form of construction with which the Speed Box is cast integral. *The housings* are of box section, with wide faces, and designed for the greatest possible rigidity. *The cross-rails* are of heavy box form, with a deep arch at the back, which resists the strain of the heaviest cuts. *The heads* have the long, narrow guide bearing at bottom of rail. Both Heads have Rapid Power Traverse in all directions. Eight feeds are provided on the 4' and 5' Mills, ranging from  $\frac{1}{24}$  to  $\frac{3}{4}$ . Ten feeds are provided on the 6' and 7' Mills ranging from  $\frac{1}{28}$  to  $\frac{7}{8}$ .

**Spur Gear Type:** These Boring Mills are made in the following sizes: Massive Type, 8 ft., 10 ft., 12 ft., 14 ft. and 16 ft., 10-16 ft. Extension.

**GENERAL DESCRIPTION:** *The bed* is of deep box form throughout. All parts are thoroughly ribbed and braced and the entire mechanism of the mill is supported on the bed. *The table* is large

in diameter and supported on a broad, flat annular bearing of large diameter. *The main driving gear* is an internal spur gear cut from the solid. *The housings* are



Standard Boring Mill

of massive box form, a wide and long base insuring rigidity under the most severe duty. *The cross-rail* is of box form and has a deep arch on the back so that any deflection due to weight of heads or pressure of the cut is reduced to a minimum. *The heads* have the narrow guide bearing at bottom of rail, which prevents all tilting or binding while heads are under cutting strain. *Eight different feeds* are provided ranging from  $\frac{1}{32}$ " to 1". Both heads have rapid power traverse.

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Our facilities for building a very high grade product are unexcelled. Our system of inspecting each piece before allowing it to proceed to the next department assures the accuracy of every detail. We have a complete equipment of jigs and fixtures which further assures all parts being made interchangeable.

A test card of the final inspection of every machine is recorded and filed in our office. Each machine is required to show within the limit of error and is tested under actual operating conditions before shipment.

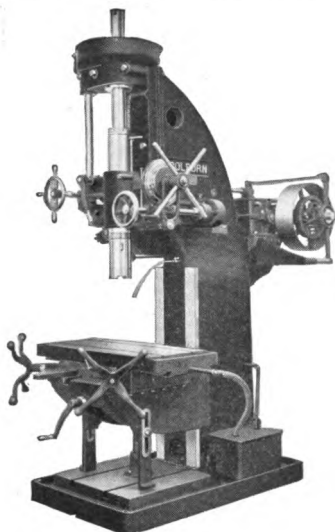
## COLBURN MACHINE TOOL CO.

FRANKLIN, PA., U. S. A.

Heavy Duty Drills—Vertical Boring Mills

### COLBURN D-TYPE HEAVY DUTY DRILL PRESSES:

Designed primarily to meet the exacting demands of Heavy Duty Drilling, tapping, boring, reaming, facing, under-



D8 Heavy Duty Drill Press

cutting, counterboring, trepanning, and like operations.

The size here illustrated has a drilling capacity to the full cutting edge of a 5 inch high speed drill in solid steel. Gears are heat-treated and hardened, and run continuously in a bath of oil. Shaft journals in speed box are equipped with combined radial and thrust ball bearings. The spindle is forged high carbon steel of extra large dimensions, double splined, thus equalizing the excessive strain exerted on the sides of the keys when driving large drills and boring tools. The spindle thrust is taken by self-aligning ball bearings. All levers are located at front of machine within easy reach of the operator. Furnished with plain or compound table.

Built in three sizes:

D4—24" swing— $3\frac{1}{2}$ " drilling capacity.

D6—36" swing— $3\frac{1}{2}$ " drilling capacity.

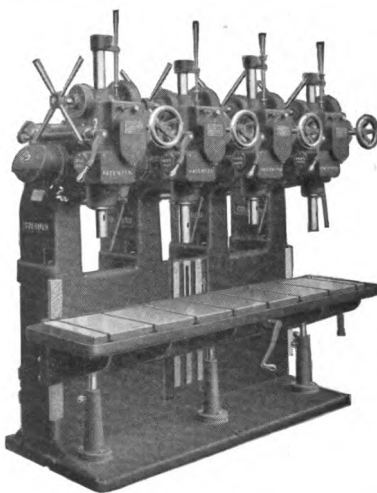
D8—36" swing—5" drilling capacity.

### COLBURN MANUFACTURING TYPE HEAVY DUTY DRILL PRESS:

This manufacturing drill press, while originally designed as a single purpose machine for drilling large quantities of duplicate parts, has an ingenious patented device which gives practically an unlimited range of speeds and feeds thus greatly enlarging its field of usefulness.

Built with one, two, three, or four spindles to suit requirements.

If you have duplicate pieces to drill, ream, tap, counterbore, face, undercut, etc., this machine will greatly increase



Four Spindle No. 2 Manufacturing Drill Press

your production and reduce your manufacturing costs.

Bulletins illustrate and describe the various sizes we build.

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## COLBURN MACHINE TOOL CO.

FRANKLIN, PA., U. S. A.

Vertical Boring Mills—Heavy Duty Drills

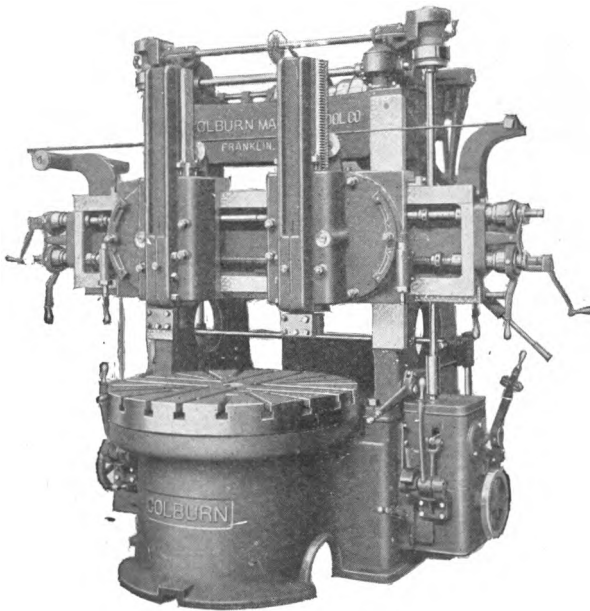
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### COLBURN VERTICAL BORING AND TURNING MILLS:

To obtain maximum production, likewise minimum shop cost, on a Vertical Boring and Turning Mill, it is essential

The operator does not move from his regular working position in making changes.

Power rapid traverse is provided for the heads, always reversing the direction



459

Colburn 48" Boring and Turning Mill

that the machine be of staunch and sturdy build and have powerful drive and feed mechanism, massive cross rail, heads, table, etc. It must also at all times be under the quick and easy control of the operator.

The Colburn meets fully these essential requirements. Speed and feed changes are readily made. Controlling levers are located at the front of the machine and duplicated at either side.

in which the tool may be feeding. This avoids any possibility of damaging the work.

A brake quickly stops the table at any predetermined point. Driving gears run in a bath of oil. There are many other interesting details.

Built in five sizes: 42, 48, 54, 60 and 72 inch swing.

Let us send our complete catalog, or bulletins of any size you are interested in.

## NILES-BEMENT-POND COMPANY

GENERAL OFFICES, 111 BROADWAY, NEW YORK

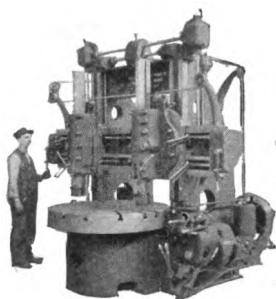
BOSTON  
PHILADELPHIA  
BIRMINGHAM  
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CLEVELAND  
CINCINNATI  
DETROIT  
CHICAGO  
ST. LOUIS

DENVER  
LOS ANGELES  
SAN FRANCISCO  
SEATTLE

**Manufacturers of Steam Hammers, Electric Traveling Cranes and Complete Machine Tool Equipments for General Machine Shops, Railroad Shops, Ship and Navy Yards and Heavy Ordnance or Small Arms Arsenals**

### MACHINE TOOLS:



460 We build heavy machine tool equipment for shops of every size.

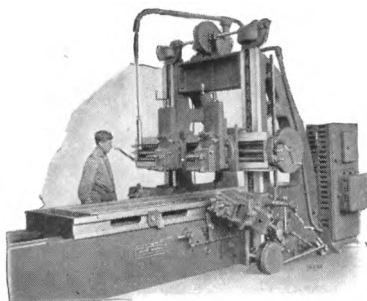
For railroad manufacturing and repair shops.

For general manufacturing.

For shipyards, dry docks and Navy yards.

For Small Arms Arsenals, Gun and Projectile manufacturing plants.

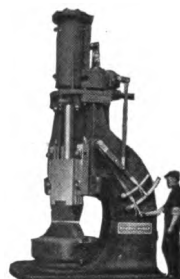
These machines are representative of the best practice in tool construction. They include lathes, planers, boring mills,



slotters, drilling machines, milling machines, shapers, boring and drilling machines, boring, drilling and milling machines, shears, punches and presses, etc.

### STEAM HAMMERS:

Bement Steam Hammers are built in single-frame, double-frame and drop-hammer types. They are entirely dependable and are so designed that with very little attention they can be operated continuously without breakdowns. In their construction only the best material and workmanship are used.



### TRAVELING CRANES:

We build various types of Electric Traveling Cranes, trolleys and hoists. They are designed to obtain the highest operating efficiency with the lowest cost of maintenance. We are at all times ready to aid you in the solution of your handling problems.



Catalogues, Circulars and Full Information on request.

*Precision Machine Tools, Small Tools, Gages*

## PRATT & WHITNEY COMPANY

GENERAL OFFICES, 111 BROADWAY, NEW YORK

WORKS: HARTFORD, CONN.

Warehouse Stocks in

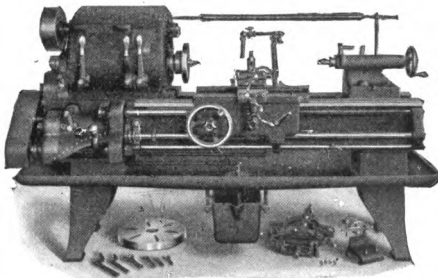
NEW YORK  
BIRMINGHAM  
CLEVELAND  
CHICAGO  
DENVER

BOSTON  
ROCHESTER  
DETROIT  
ST. LOUIS  
SEATTLE  
LOS ANGELES

PHILADELPHIA  
PITTSBURGH  
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SAN FRANCISCO

**Manufacturers of Precision Machine Tools, Small Tools, Gages and Standards, Hoke Gages, P. & W. Measuring Machine**

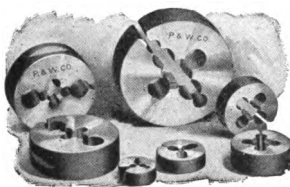
### PRECISION MACHINE TOOLS:



As originators of the system of interchangeable manufacture, Pratt & Whitney Company have developed a line of Precision Machine Tools unequalled for accuracy and refinement. They include Bench, Engine and Turret Lathes, Hand Screw Machines, Hand and Power Milling Machines, Die Sinkers, Sensitive and Multiple Spindle Drills, Vertical Surface Grinders, etc. Special and original with us are Automatic Milling Machines, Horizontal Automatic Profiling and Cam Cutting Machines, Vertical Shapers, Jig Boring Machines, Contour Cutter Grinder, Thread Miller and Spline Miller.

### SMALL TOOLS:

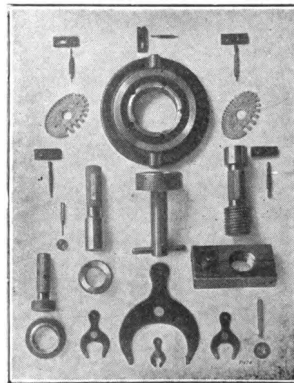
Pratt & Whitney Small Tools enjoy an enviable reputation for high quality.



Where stamina as well as accuracy are required of the small tool equipment, Pratt & Whitney tools have more than held their own. We can honestly recommend them—our line is complete.

### GAGES AND STANDARDS:

Recent developments in Pratt & Whitney Gage manufacture are the Hoke Gages, Swedish Type Gages, 'Mike-



461

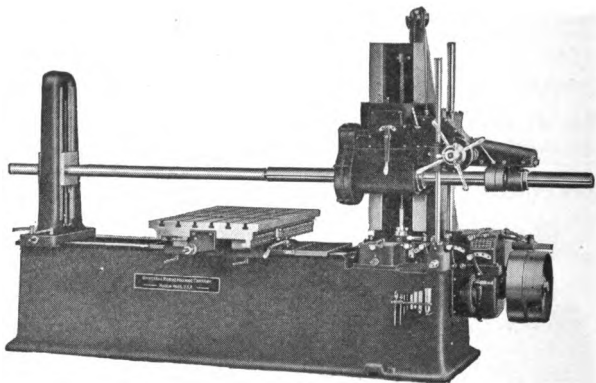
checks,' Toolmakers' Flats. By means of the Hoke Gages measurement to the millionth of an inch is made possible. We also supply a full line of standard Thread Gages, Plug and Template Gages, Snap Gages, M. C. B. Gages for railroad use, as well as special gages for multiple manufacturing.

Catalogues, Circulars and Full Information on request.

# UNIVERSAL BORING MACHINE CO.

HUDSON, MASS.

## UNIVERSAL (HORIZONTAL) BORING MACHINES



### Regular Equipment

For No. 3½ Machine.

462

One 3" Plain Extension Boring Bar,  
with No. 6 Morse Taper at one end,  
also sleeves, cranks and wrenches.

### Special Equipment

Special Tables, Rotary Tables, Star  
Feed Facing Head, and Face Milling  
Cutters.

### Regular Equipment

For No. 3A Machine.

One 2½" Plain Extension Boring Bar,  
with No. 5 Morse taper at one end,  
also sleeves, cranks and wrenches.

### Special Equipment

Same as for the No. 3½ Machine.

Send for Catalogues.

### STANDARD SPECIFICATIONS

Size of Machine	No. 3½	No. 3-A
Diameter of main boring bar.....	3½"	3"
Taper hole in main boring bar, Morse.....	No. 6	No. 5
Travel of main boring bar, automatic.....	30"	28"
Travel of main boring bar, by resetting.....	54"	56"
Size of table.....	30" x 48"	24" x 48"
Power cross feed to table.....	36"	36"
Power longitudinal feed to carriage.....	56"	38"
Power vertical feed to head.....	30"	26"
Maximum distance from table to center of bar.....	30"	26"
Greatest distance from face plate to outer support.....	84"	60"
Number of spindle speeds.....	16	16
Range of spindle speeds (about R. P. M.).....	15 to 200	15 to 200
Number of feeds (in either direction).....	9	9
Number of feeds, etc.....		
Milling feeds (inches per minute).....	¾ to 5½"	¾ to 5½"
Boring feeds (inches per minute).....	¾ to 2¾"	¾ to 2¾"
Speed of driving pulley (R. P. M.).....	250	230
Shipping weight, crated, about.....	11,000 lbs.	9,500 lbs.
If motor required.....	7½ H. P.	5 H. P.



# THE DEMCO MACHINE TOOL CO.

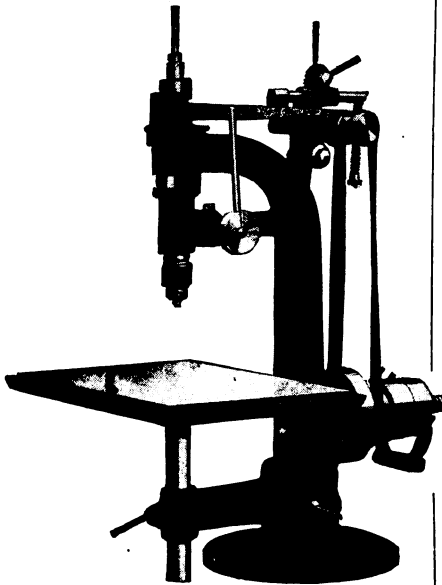
CLEVELAND, OHIO

Manufacturers of Demco High Speed Ball Bearing Drills

## DEMCO DRILLS:

If you would increase production, reduce drill breakage to minimum and produce work of a higher quality, Demco High Speed Drills will do it.

Because of their extra heavy, well anchored construction, they are vibrationless, even up to 12,000 R. P. M.



At this speed the drill cuts the material instead of being forced through it such as takes place with drills revolving at slower speeds.

All parts are perfectly balanced and "Norma" Annular Ball Bearings are used throughout.

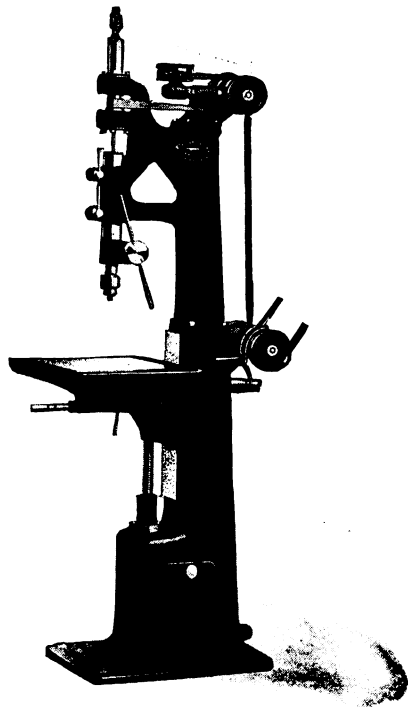
These drills are made in several types, light and heavy models and for bench or floor installation. They are equipped with motor drive or driven from overhead line shafting. Each machine has several speed changes. Drills may be furnished single—or multi-spindle, with a choice of 4 types of spindles.

We manufacture one type of machine, our No. 40, which we recommend to give excellent service in performing the accurate, painstaking operations of drilling, tapping, and milling in the tool room, or for general service in the shop or school room.

Our No. 38 machine will tap right and left hand and has a quick open belt reverse for backing out tap. All controls are brought to the front. Spindle is of the quick returning type. This is the only machine manufactured which has both sensitive and positive feed.

Nowhere in the design, purchase of material, or workmanship have we stinted in the manufacture of Demco Drills, Drilling and Tapping Machines and Drilling, Tapping and Milling Machines.

*Send for Bulletin.*



# LYND-FARQUHAR COMPANY

419-425 ATLANTIC AVE.  
BOSTON, MASSACHUSETTS

## Machine Tool Values

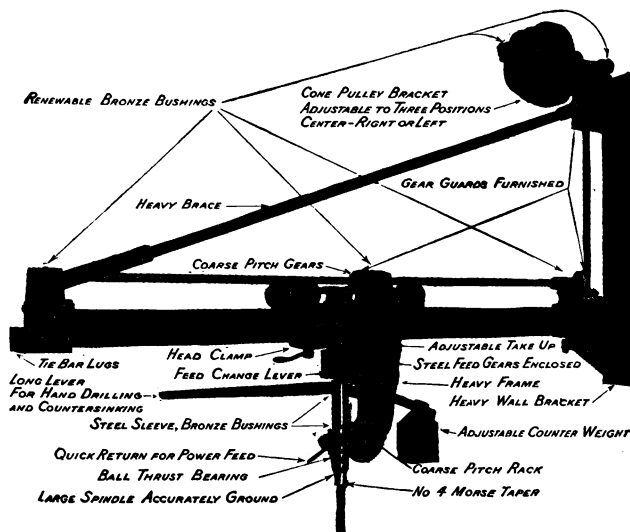
### LYND-FARQUHAR WALL RADIAL is a decided success:

It is a real machine tool; all gears accurately cut from the solid; gears in power feed mechanism of steel; hand lever and positive geared power feeds; spindle provided with ball thrust; spindle sleeve bronze bushed top and bottom which makes a renewable condition should it prove necessary; bearings throughout are bronze bushed; flanged

### COMBINED OPEN SIDE CRANK PLANER AND SHAPER:

Our 26" Combined Open Side Crank Planer and Shaper is also a machine that cannot be surpassed for the tool room. As an illustration, on 20-point carbon steel, the length of cut was 20", strokes per minute 18, with a depth of cut  $\frac{7}{16}$ " and feed .015". This was not a test but an actual commercial job in an up-to-date machine shop.

464



wheels carrying head are roller bearing, and the entire operating control is within easy reach of the operator. Made in four standard sizes as follows:

Size	Drills to Center of	Wall to End of Arm	Net Weight Lbs.
7 ft.	14-ft. circle	10 ft. 4 in.	3380
9 ft.	18-ft. circle	12 ft. 4 in.	3483
11 ft.	22-ft. circle	14 ft. 4 in.	3615
13 ft.	26-ft. circle	16 ft. 4 in.	3750

Other special lengths of arm can be furnished to suit requirements.

ENGINE LATHES, RADIAL DRILLS, UPRIGHT DRILLS, SHAPERS, PLANERS, SCREW MACHINES, COLD SAW CUTTING OFF MACHINES, GRINDING MACHINERY, PRECISION MACHINERY AND SPECIAL METAL WORKING MACHINERY have been furnished by us to the large manufacturers throughout the country. Let us know your requirements. We are in a position to serve you to advantage.

Write us for complete information and prices.

# THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA

Makers of Multiple Spindle Drilling and Tapping Machinery

## NATCO MULTI-DRILLERS:

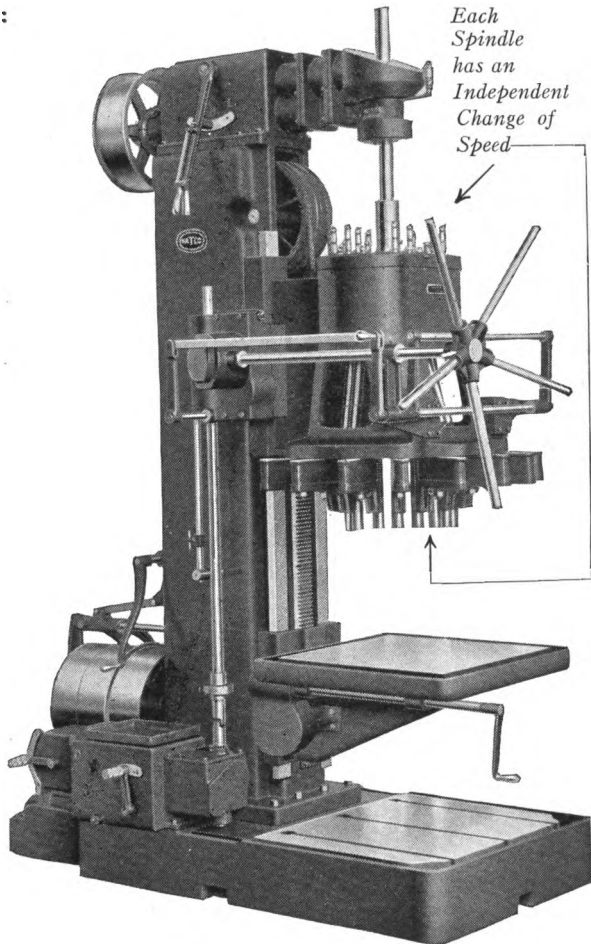
Each spindle on a NATCO equipped with our patented feature has an independent change of speed. The notched plungers indicate the speed of the spindle.

This arrangement makes it possible to drill, ream, tap, counterbore or spot-face different sized holes in one operation—each tool driven at its approximately correct cutting speed.

The advantages are many—increased production, fewer operations, lower cost, minimum wear and breakage of tools, and as idle spindles are in neutral it saves wear, also power.

NATCO one nut adjustable arms and patented cluster plates make quick adjustment and complicated layouts possible.

NATCOS are built in eleven sizes ranging from 2 to 72 spindles and with drilling capacity of  $1\frac{1}{4}$ " in cast iron or 1" in steel. Our regular line is very complete but if you require special drilling machinery we are in position to build it.



465

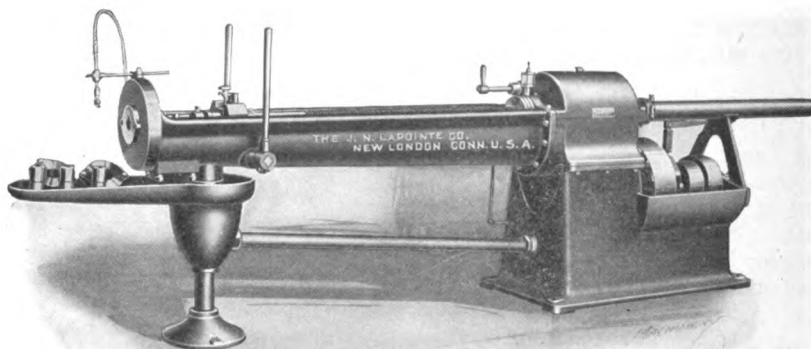


*We invite you to put your drilling problems, jig and fixture work up to us.*

## THE J. N. LAPOINTE CO.

NEW LONDON, CONN.

Manufacturers of Broaching Machines and Broaches



No. 3B Broaching Machine. Code Word--*Standard*.

One of 11 types and 5 sizes made by the J. N. Lapointe Co.

### 466 SPECIFICATIONS:

Capacity: Cutterbars..... $1\frac{5}{8}$ " wide  
Square broaches.. $3\frac{1}{4}$ " square  
Stroke.....56"  
Driving screw..... $2\frac{3}{4}$ " 2 pitch  
Length of drawing nut..... $8\frac{1}{2}$ "  
Cutting speed.....4' 6" per minute  
Hole in faceplate.....5" diameter  
Vertical adjustment of drawhead... $3\frac{1}{4}$ "  
T. & L. counter pulleys....18" diameter  
Counter speed.....400 R. P. M.  
Driving pulley on machine...18" diameter  
Floor space.....18' 6"  $\times$  23"  
Net weight.....3100 lbs.  
Gross Weight, domestic.....3470 lbs.  
Size of Motor.....8 H. P.  
Speed of Motor.....1000 R. P. M.

#### Standard equipment:

Reducing bushings..... $1\frac{1}{2}$ ", 2",  $2\frac{1}{2}$ "  
Pull bushings..... $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ", 1"  
Gross Weight, export.....3930 lbs.  
Size of Box, export.....180"  $\times$  49"  $\times$  29"

No other machine shop operation has extended in use relatively so rapidly during recent years as has broaching—due to increasing knowledge of its adaptability to a wide range of work and its surprising economy in production time and costs.

The improvements in broaching machines and broaches—largely the direct result of years of experience and effort of a few men—have brought broaching to a point where it is now considered indispensable on certain classes of work.

Since broaching to exact size does not depend on the skill of the operator—which need be only sufficient to run the machine—quality as well as quantity of work is attained. Thus broaching simplifies at once the problems of labor and increased production.

Broaching machines and modern broaching practice are interestingly discussed in the J. N. Lapointe Co. catalog—which will be mailed upon request.

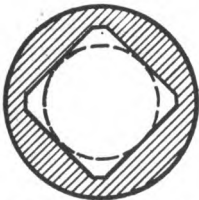
## THE LAPOINTE MACHINE TOOL CO.

HUDSON, MASSACHUSETTS, U. S. A.

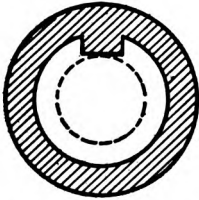
Manufacturers of Machines and Tools for Broaching

### LAPOINTE BROACHING MACHINES

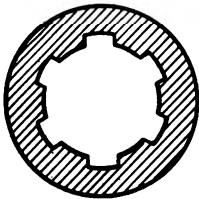
are made in four different sizes, No. 1, No. 2, No. 3, and No. 4. Any size can be arranged for motor drive either direct connected or silent chain drive. These machines are designed for strength, rigidity, durability, convenience of operation, and adaptability for all classes of work required of a Broaching Machine.



From Round to Square in Less than One Minute

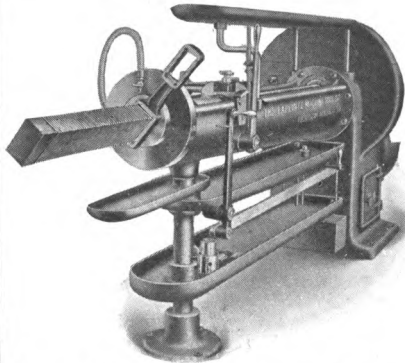


From Round to Solid Key in Less than Two Minutes

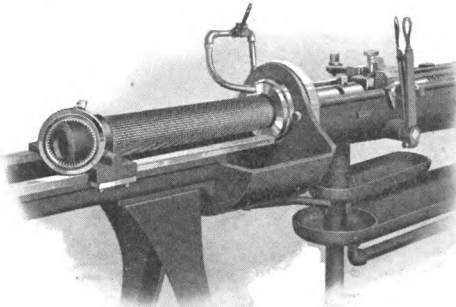


From Round to Six Spline in Less than One Minute

The small machines are used for cutting single keyways and broaching small square holes, or any other broaching work within their capacity. The larger machines are used extensively for broaching multiple spline holes, Internal Gears, large square, hexagon and rectangular holes, also for sizing round holes up to 5" in diameter.



No. 4 Machine: Capacity to cut keyways 4" wide or broach square holes in steel up to 4" across flats from a drilled hole



Broaching Two 5" x 1/2" Steel Internal Gears in One Minute

The manufacture of broaching tools is a specialty that requires not only expert toolmakers but a great many special machines, together with all the modern appliances for hardening, tempering, and straightening broaches. We are the pioneers in this industry and our product is the result of nearly twenty years' experience. Every broach is tested for strength and accuracy before being shipped.

*The oldest and largest company in the world manufacturing Broaching Machines and Broaching Tools exclusively.*

## THE FELLOWS GEAR SHAPER CO.

SPRINGFIELD, VERMONT, U. S. A.

Sole Makers of the Fellows Gear Shapers and Gear Shaper Cutters

### THE FELLOWS SPUR GEAR SHAPER:

The Fellows Spur Gear Shaper is a gear-generating machine designed especially for the economic and accurate production of spur external, internal, shoulder or cluster gears.

### NO. 6 FELLOWS SPUR GEAR SHAPER:

The Spur Gear Shaper is made in a variety of types to accommodate various classes of work. The No. 6 Gear Shaper has a capacity for cutting external spur gears having a pitch diameter of 35", 4 diametral pitch and 5" face, and internal spur gears having a pitch diameter of 25", 4 diametral pitch and 3" face.

### NO. 61 FELLOWS GEAR SHAPER:

The No. 61 Gear Shaper is adapted to hold shank gears. Gears having a shank diameter of from  $2\frac{1}{4}$ " to  $2\frac{7}{8}$ ", depending on the design, can be satisfactorily held.

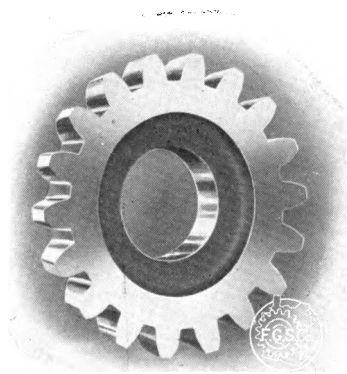
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### NO. 62 FELLOWS GEAR SHAPER:

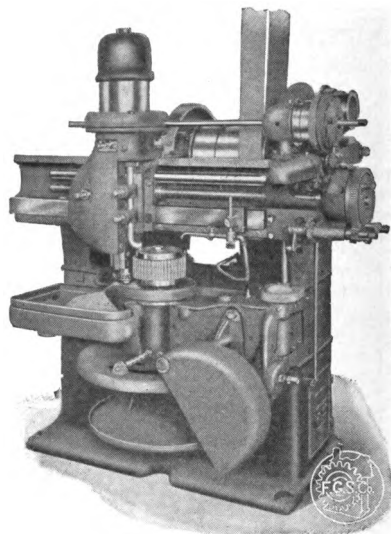
The No. 62 Gear Shaper is designed especially for the cutting of coarse pitch gears. It carries Gear Shaper cutters having a hole  $1\frac{3}{4}$ " instead of  $1\frac{1}{4}$ " in diameter, as is the case with the No. 6.

### NO. 612 FELLOWS GEAR SHAPER:

The No. 612 Gear Shaper is a combination of the Nos. 61 and 62 machines, having both a large work-spindle and a large cutter-spindle.



Fellows Spur Gear Shaper Cutter



No. 6 Fellows Spur Gear Shaper

### NO. 64 FELLOWS GEAR SHAPER:

The No. 64 Gear Shaper is a machine designed especially for cutting gears having large shanks. It has a hole through the work-spindle to accommodate a shank 5" in diameter, and is provided with the standard cutter-spindle.

### NO. 624 FELLOWS GEAR SHAPER:

This is a combination of the Nos. 62 and 64 machines having a work-spindle of large diameter—capacity for 5" shanks—and a large cutter-spindle carrying cutters having  $1\frac{3}{4}$ " hole. This machine is used in connection with machine tool plants for cutting quill gears and similar work.

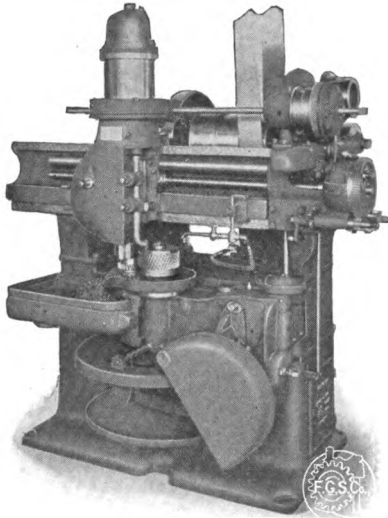
### THE GEAR SHAPER CUTTER:

The Gear Shaper Cutter is a high production tool, and in addition produces an extremely fine finish on the gear tooth, owing to the peculiar action of the cutter as it rolls in mesh with the gear it is cutting. It therefore possesses all of the necessary features for an accurate and economical method of cutting gears. The principle of the Gear Shaper Cutter can also be applied to a variety of other shapes. Those interested in the generating of accurate work are requested to send for our literature covering this subject.

# THE FELLOWS GEAR SHAPER CO.

SPRINGFIELD, VERMONT, U. S. A.

Sole Makers of the Fellows Gear Shapers and Gear Shaper Cutters



No. 65 Fellows Helical Gear Shaper

## THE FELLOWS HELICAL GEAR SHAPER:

The helical gear is considered as being a more efficient gear than a spur gear when properly cut, and for this reason it is recommended where quiet and efficient operating gears are demanded.

The two features of a helical gear that require considerable attention are accuracy of tooth outline and uniformity of helix angle. Two meshing gears, for instance, must have exactly the same helix angle or they will not operate properly together.

In the Fellows Helical Gear Shaper these two points are controlled in the following manner. The accuracy of the involute tooth outline of the gear is controlled by a cutter which is ground all over after hardening, removing all possible distortion. The uniformity of the helix angle is controlled by positive helical guides having the same helix angle as that of the cutter. These guides are made right- and left-hand, as is also the case with the cutters.

## NO. 65 FELLOWS HELICAL GEAR SHAPER:

This is the standard size of Helical

Gear Shaper and has a capacity for cutting external helical gears of 26" pitch diameter, 5" face,  $\frac{5}{7}$  diametral pitch, and internal helical gears 24" pitch diameter, 3" face and  $\frac{5}{7}$  diametral pitch. The cutters used have holes  $1\frac{1}{4}$ " in diameter.

## NO. 615 FELLOWS HELICAL GEAR SHAPER:

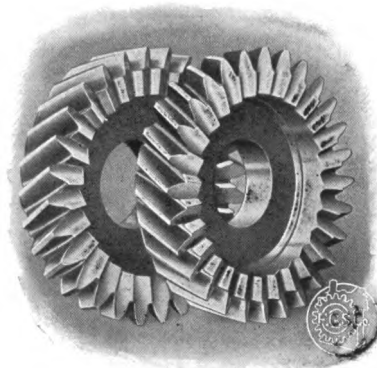
The No. 615 Gear Shaper is a combination of the Nos. 61 and 65 machines.

## NO. 645 FELLOWS HELICAL GEAR SHAPER:

This machine is a combination of the Nos. 64 and 65 machines having a large work-spindle, which has a capacity for shank gears 5" in diameter. It is recommended especially for the cutting of herringbone and helical gears for reduction mechanisms.

## LITERATURE ON GEARING:

The Fellows Gear Shaper Company, 469 appreciating the necessity for accurate and reliable literature on the subject of gear cutting, has published a series of booklets



Right- and Left-Hand Helical Gear Shaper Cutters

dealing with various phases of gear design and gear cutting. A few of the titles are:

- "Commercial Gear Cutting"
- "The Involute Gear"
- "The Stub Tooth Gear"
- "The Internal Gear."



These booklets will be gladly sent to any address upon request.

## THE HERCULES MACHINE & TOOL COMPANY, INC.

SALES OFFICE  
50 Church Street, New York City

WORKS  
Poughkeepsie, New York

### HERCULES EIGHT-INCH GEAR HOBBER:

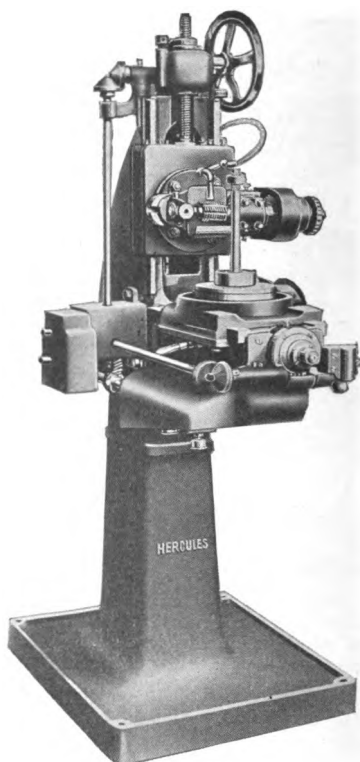
The method of manufacturing gears with the use of the hobber is now generally understood and appreciated. The hob may be described as a spiral circular rack, the thread on which is identical to a rack of an equal pitch.

One hob of each pitch is required when cutting gears of any number of teeth. The same hob can be used to cut spirals of either right or left hand to 70 degrees. The teeth curves are generated by the relative rotative motion of the hob and the work.

470

Hobbing is a continuous cutting operation, therefore this system makes it possible to produce a greater quantity of gears in the same cutting time than the practice followed in the past. In all other systems of gear cutting, there are idle or non-productive strokes.

The Eight Inch "Hercules" Gear Hobber, as illustrated, has been designed especially for the rapid and economical production of small gears such as used in phonographs, meters, typewriters, moving picture apparatus, adding machines, instruments of precision, and, in general, all gear cutting up to ten pitch in steel, eight pitch in cast iron or brass. It will cut spur, spiral and worm gears, and is fully automatic.



Regular equipment:—1 hob arbor,  $\frac{3}{4}$ " diameter; 1 work arbor,  $\frac{3}{4}$ " diameter; 1 set of change gears cutting up to 360 teeth; 1 set of change feed gears; wrenches; chart.

We shall be glad to send you circulars, upon request, showing our 24" high duty manufacturing gear hobber for both spur and spiral gears, in which we have incorporated many novel features.

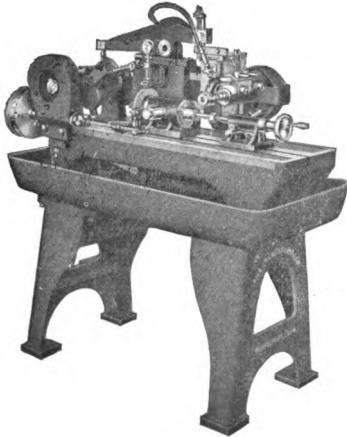


## THE BILTON MACHINE TOOL CO.

BRIDGEPORT, CONN., U. S. A.

**Manufacturers of Automatic Gear Milling Machines, Gear Hobbing Machines, Automatic Milling Machines, Automatic Slitting Machines for Knitting Machine Trade, Plain and Ball Bearing Sensitive Drill Presses, Plain Milling Machines, Riveting Machines**

### AUTOMATIC GEAR MILLING MACHINES:



Made in 3 sizes for spur or bevel gears.

No. 1	1½	4" dia.	14 pitch
No. 2	2½	6" dia.	10 pitch
No. 3½		8" dia.	8 pitch

These machines can be adapted to a large variety of special form milling which can only be done to advantage on these machines. Used on milling cutters, reamers, taps, cylinders, also small worms with attachment.

*Our catalogue No. 15 shows what can be accomplished.*

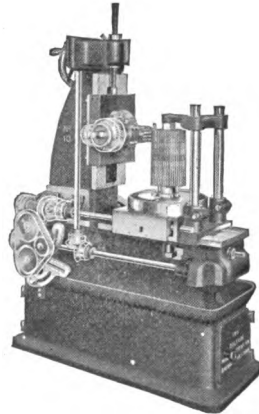
#### SPECIAL FEATURES:

- Entirely automatic action.
- Positive and direct indexing to the work.
- Cutter clears work while indexing.
- Quick releasing fixture for removing work.
- Large production through quick action of machine.
- Exceptional wide range of usefulness.



The above sizes are also made in vertical type used for milling and slotting sinker rings, dials, plates, milling cutters. Range up to 18" dia.

### UNIVERSAL GEAR HOBGING MACHINES:



Capacity: 10" dia.  
10 pitch  
10" width of face  
weight 2100 lbs.

471

Will automatically hob spur spiral gears, worms and worm gears, also variety of special shapes.

Base and oil pan extra heavy with liberal reinforcements to absorb vibration. Work table driven by large bronze worm gear and worm and automatically lubricated. Machine uses least possible number of feed and index gears. Hob spindle bored for No. 9 B & S Taper, driven by Helical gear 8-10 pitch. Machine entirely of latest design with new feature to increase production without sacrificing accuracy.

*Send for catalogue.*

**Plain Horizontal Knee and Column Type Milling Machines, 27"x8"x18", weight 1900 lbs.**

**High Speed Ball Bearing Drill Press, 7/8" capacity, 4 and 6 spindle.**

**Automatic Cam Feed Drill Press, 1/2" capacity, weight 1800 lbs.**

**MILL-IT-AUTOMATIC**  
Machines for automatic milling.

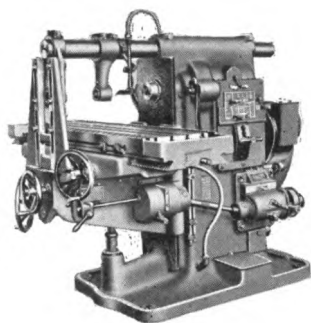
**FOREIGN AGENTS:** Chas. Churchill Co., Alfred Herbert, M. Mett. Eng. Co.



## **BROWN & SHARPE MFG. CO.**

PROVIDENCE, R. I., U. S. A.

**Machine Tools—Small Tools—Cutters**

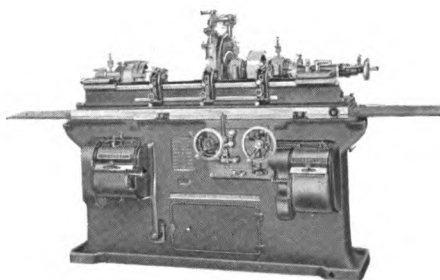


### **MILLING MACHINES:**

Plain, Universal and Vertical ranging  
from light Hand Milling Machines to the  
472 Heavy Service Type.

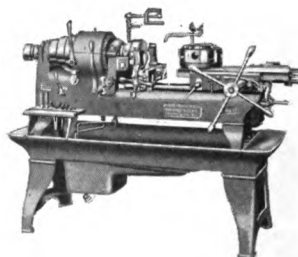
### **MILLING CUTTERS:**

Standard or Special Milling Cutters in  
all sizes.



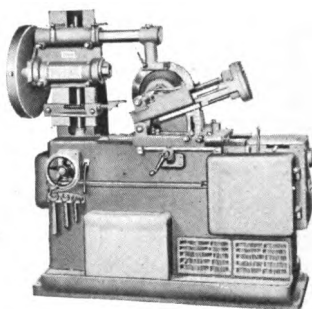
### **GRINDING MACHINES:**

Plain, Universal Surface and Cutter for  
Commercial Grinding or Finishing. Used  
on the manufacturing floor or in the tool  
room.



### **SCREW MACHINES:**

Plain, Wire Feed and Automatic  
suitable for manufacturing duplicate parts  
in large quantities.



### **AUTOMATIC GEAR CUTTING MACHINES:**

Spur and Bevel, cutting spur gears  
up to 72" diameter. Also machines  
for cutting both Spur and Bevel Gears.

### **MACHINISTS' TOOLS:**

A complete line of tools for operator,  
tool room or machinist.

## GOOLEY & EDLUND, INC.

CORTLAND, N. Y., U. S. A.

Manufacturers of High Duty Milling Machines

### BRIGGS MILLING MACHINES:

solid arched frame with the heavy bed strongly gibbed to both sides give a

#### FEATURES:

—  
CONVENIENCE  
OF OPERATION

—  
HIGH  
PRODUCTION

—  
RIGIDITY

—  
POWER

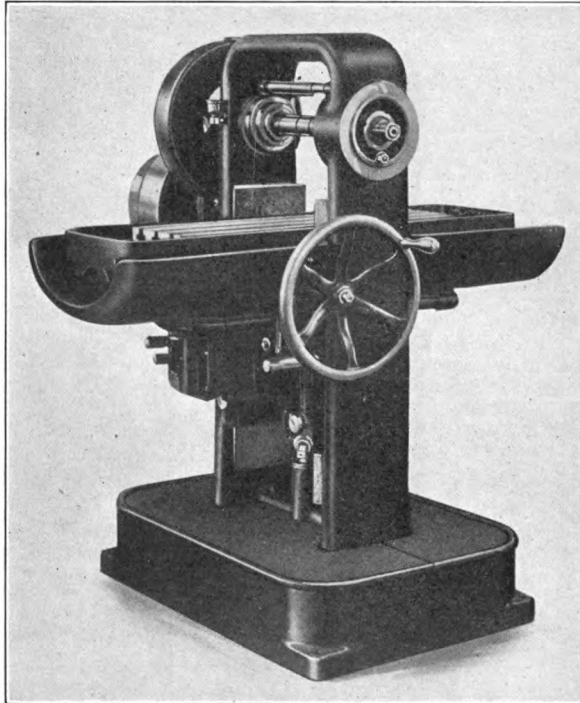
—  
SIMPLICITY

—  
ALIGNMENT

—  
AMPLE MEANS  
FOR  
LUBRICATION

—  
WORKMANSHIP

—  
DURABILITY



473

A manufacturing machine particularly adapted to the making of automobile, gun and similar parts where close limits and smooth cutting are required in the rapid production of duplicate parts.

A radical departure has been made from conventional milling machine design to secure greater rigidity and power than is possessed by any other machine of corresponding size and weight. The

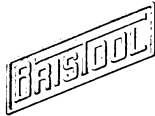
rigidity of relation of arbor to table which is not disturbed by the stress and vibration of heavy cuts of high speed or hard steels.

The powerful rigid feed, quick table return, ease and speed of handling, and simple and rigid construction are a few of the good features which we would like to tell you more about.

## THE BRISTOL MACHINE TOOL CO.

BRISTOL, CONN.

Manufacturer of Hand and Vertical Milling Machines, Piston Ring Grinders,  
Precision Surface Grinders



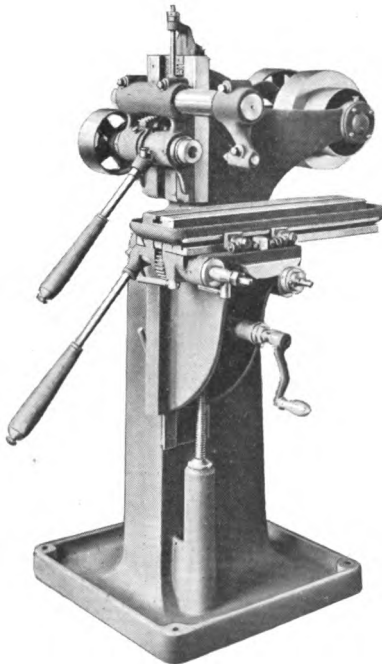
This trade mark on a machine means that "Quality First" is the basis of its manufacture. Nothing but the best of materials are used—suited chemically and physically for the task they must perform. The raw materials are wrought to their final state by skilled mechanics and when the finished product is delivered to you this mark means you have the best.

### BRISTOL HAND MILLING MACHINE:

Made also in Heavy Type belt driven, Heavy Type back geared spindle and Power Feed Table Type.

These machines give excellent service when used for keyseating, gear and sprocket cutting, slotting, straddle milling, cam cutting and similar classes of work, especially in the manufacture of small parts where accurate duplication is essential.

474 For this class of work these machines are best since any other of the larger millers



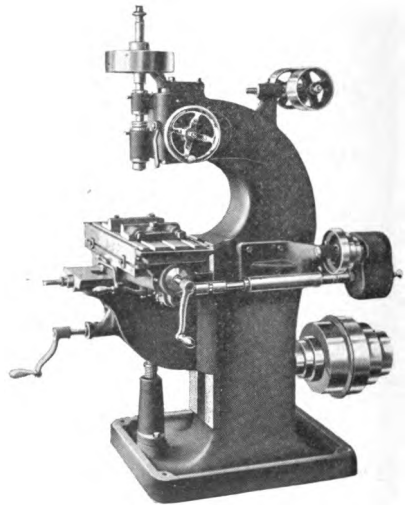
Standard Type Hand Miller

are an expense and needless liability.

The controls are all arranged conveniently. The flexibility of manipulation is evidenced on profiling jobs when the spindle may be brought close to the table and the work guided by the independent vertical and horizontal feeds.

Made in three sizes or types: No. 0 (illustrated), the standard machine; No. 1, a heavy type designed for use on work requiring a heavier machine than the standard; No. 2, a heavy type designed for heavy cuts and equipped with back geared spindle of planetary type giving two speeds to spindle without change of pulleys.

### BRISTOL VERTICAL MILLING MACHINE:



10" x 28" Belt Driven with Plain Vise Jaws

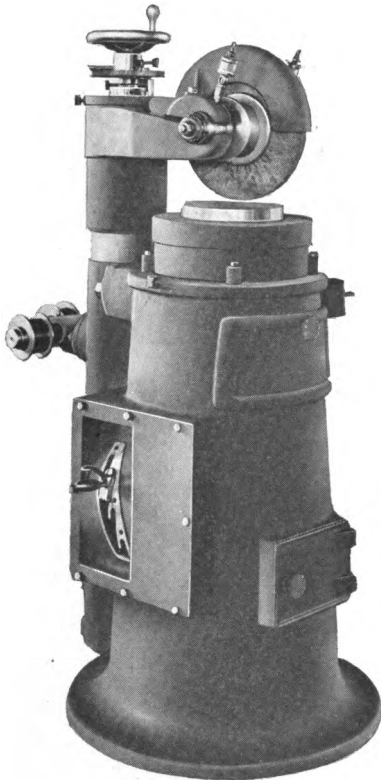
Also made with a Rotary Table. The painstaking workmanship and selected material, coupled with ball bearings and belt drive, assure the purchaser an extra smooth finish upon the work turned out. These machines are generously designed, enabling heavy cuts to be taken with cool running bearings.

This machine gives excellent results when die-sinking, profiling, circular milling and segmental milling.

Our machines pass an inspection and test that approaches scientific perfection as close as the work of any modern manufactory.

## THE BRISTOL MACHINE TOOL CO.

### BRISTOL PRECISION GRINDERS:



**8" Ring Grinder with Heald Magnetic Chuck**  
especially adapted to the rapid production  
of Piston Rings

These grinders are made in several types and sizes and are equipped with 8", 12" and 16" magnetic chucks.

For accuracy and rapid grinding of flat surfaces the rotating magnetic chuck gives the best service. Pieces may be ground singly or in multiples within the capacity of the chuck.

The new Bristol Precision Rotary Surface Grinders are constructed along simple lines with several distinctive features incorporated. The wheel spindle is mounted on a movable head attached to a very rigid column which is supported in a long housing on the back of the frame.

Dirt and grit are kept out of all bearing surfaces of column by the specially

designed lower portion of the head. This feature eliminates undue wear, such as other grinders are subject to, and makes dust guards unnecessary.

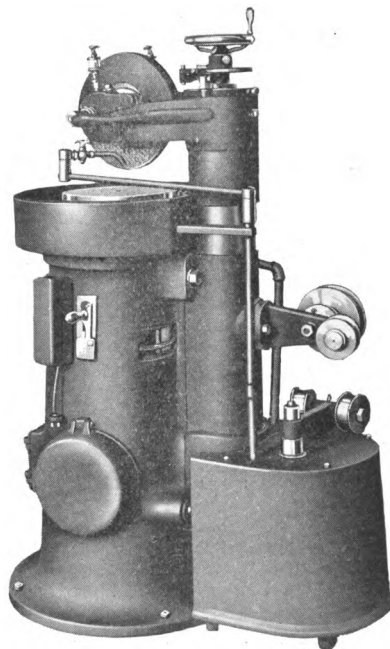
Another feature of special note is the possibility of grinding concave and convex surfaces. This is accomplished through an angular swivel adjustment of the back column (held rigid for flat surface work) permitting a range of  $4^{\circ}$  from center.

The machines are made for wet grinding or dry; may be had belt driven or motor driven and can be used with plain chucks, face plates and other fixtures as well as the magnetic chucks.

The equipment for wet grinding is furnished complete and includes settling tank, service tank, piping and a pump of a size to assure a full supply of liquid at all times.

All these machines pass through our regular inspection for material, workmanship, finish and accuracy and will grind to within a manufacturing accuracy of .00025".

475



**12" Rotary Surface Grinder with full**  
**Wet-Grinding Equipment**

## KEARNEY & TRECKER CO.

MILWAUKEE, WIS., U. S. A.

Manufacturers of Milling Machines

### MILWAUKEE MILLING MACHINES:

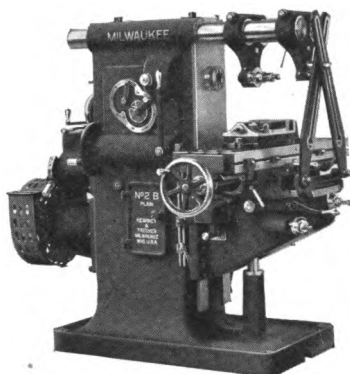
**Double Over Arm**

**Constant Speed Drive**

**Automatic Flooded Lubrication**

The **Double Over Arm** is clearly shown by the half-tone engravings and consists of two steel bars arranged accurately parallel with the spindle at sufficient distance apart to form a rigid truss when the arbor supports are clamped to them.

The **Work Table** is made of semi-steel and finished all over as experience has shown that where scale is left on one side the table does not long retain its accuracy.



NO. 2B PLAIN

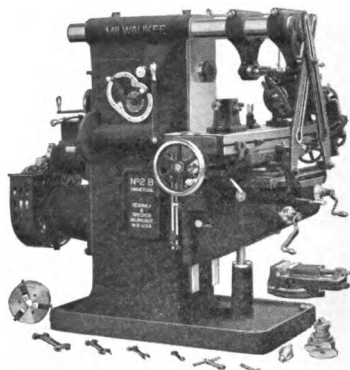
The **Box Section Knee** has no slot through the top to close under pressure of the saddle clamp or strain of the cut.

The **Flanged Spindle** provides means for holding the cutters for driving in either direction. The clutch collar keyed to the face of the spindle provides an ideal drive for the arbors.

The **Spindle Reverse** is contained within the machine so that right- or left-hand cutters can be used without reversing the driving belt.

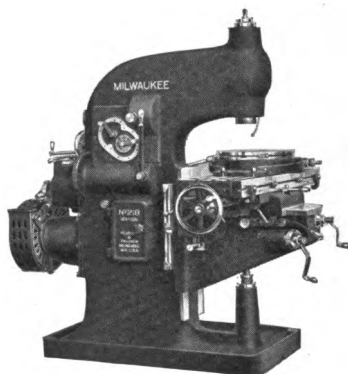
The **Drive** is through a single pulley running at a constant speed, giving 18 spindle speeds in geometrical progression of about 20 per cent.

The **Lubricating System** consists of a reservoir in the base of the machine holding several gallons of machine oil



NO. 2B UNIVERSAL

that is pumped to the top of the machine and distributed by a perforated pipe to all gears and bearings in the main frame and feed box, flooding downward over all of these on its way back to the reservoir. All oil grooves are cut through so that the oil will wash away any foreign material and keep the bearings in condition.



NO. 2 1/2 B VERTICAL

A **Cutter Lubricant Pump** is provided on every machine as all machines are usually used on steel or other material requiring lubricant. Adequate provision has been made for the return of the lubricant to the reservoir.

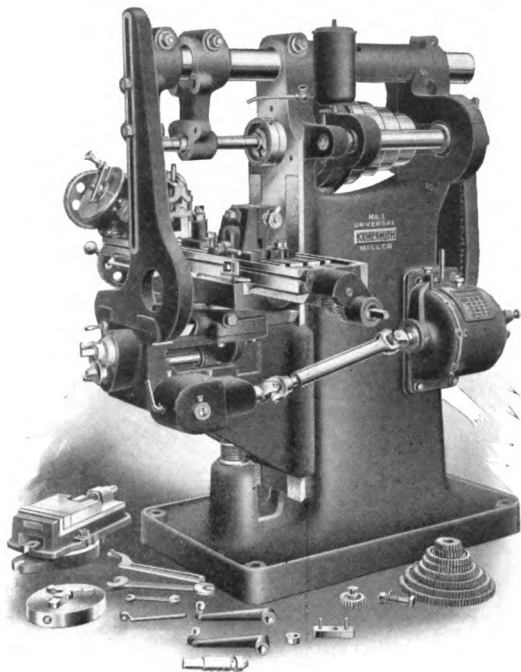
*Catalogue describing our complete production in detail, mailed on request.*

THE KEMPSMITH MFG. CO.  
MILWAUKEE, U. S. A.

KEMPSMITH MILLING MACHINES:

Both plain and universal, are built in a wide range of sizes, adapting them for use on all classes of work, from the finest precision instruments up to the heaviest automobile and aeroplane engines, tractors and agricultural machinery.

These machines can be equipped at any time with a highly effective line of attachments.



477

Kempsmith Universal Miller with Full Equipment

DIMENSIONS	PLAIN			UNIVERSAL		
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
Longitudinal table feed, Power.....	22"	28"	34"	22"	28"	34"
Transverse feed.....	8"	9"	11"	7½"	8½"	10"
Vertical feed.....	19"	19"	20"	18"	18"	19"
Table, working surface.....	42⅝"x10"	45"x10"	54"x12"	39½"x8¼"	45"x10"	52"x12"
Face of column to harness brace, in position.....	17"	20"	22"	17"	20"	22"
Spindle—taper hole (B & S).....	No. 10	No. 10	No. 11	No. 10	No. 10	No. 11
Cone, diam. largest step.....	10½"	12½"	13¼"	10½"	12½"	13¼"
Cone, number of steps.....	4	4	3	4	3	3
Belt, width.....	2¾"	3"	3½"	2¾"	3"	3½"
Spindle speeds, number.....	16	16	18	16	16	18
Vise, size and type.....	No. 3-Pl.	No. 3-Pl.	No. 4-Pl.	No. 3-Sw.	No. 3-Sw.	No. 4-Sw.
Arbor, diam. and length.....	1"x10½"	1"x10½"	1¼"x14"	1"x10½"	1"x10½"	1¼"x14"
Floor space, direction of spindle.....	56"	62"	66"	56"	62"	66"
Floor space, direction of table.....	90"	97"	114"	85"	97"	112"
Net weight.....	2750 Lbs.	3150 Lbs.	4500 Lbs.	3100 Lbs.	3600 Lbs.	5000 Lbs.
Domestic shipping wt.....	2900 Lbs.	3400 Lbs.	4800 Lbs.	3250 Lbs.	3800 Lbs.	5300 Lbs.
Export shipping wt.....	3400 Lbs.	4000 Lbs.	5200 Lbs.	3600 Lbs.	4200 Lbs.	5800 Lbs.
Dimensions of case for export, large box.....	67x36x66"	67x37x70"	72x40x72"	66x36x67"	67x37x70"	72x40x72"
small box.....			19x24x48"			19x24x48"
Cu. ft. of export cases.....	92	101	133	92	101	133
Telegraphic code word.....	KEDIV	KEDGE	KEEPER	KELK	KELPOT	KELSON

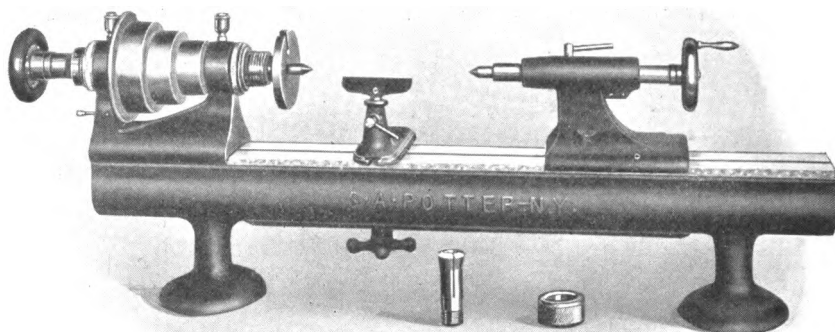
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## S. A. POTTER TOOL & MACHINE WORKS

74 EAST 130TH STREET, NEW YORK

**Manufacturers of Bench Lathes and Precision Machinery;  
Taps, Dies, Milling Cutters and Reamers**

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478

### NO. 5 PRECISION LATHE:

Swing:  $7\frac{3}{8}$ ".

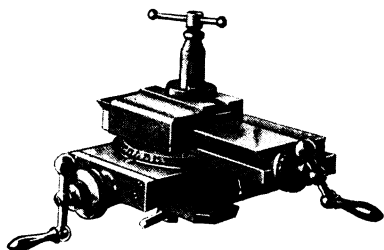
Length of Bed: 32".

Collet Capacity:  $\frac{3}{4}$ ".

**Bed:** Made of well seasoned gray iron; all working surfaces ground throughout.

**Headstock Spindle:** Double Cone Type hardened and ground running in hardened and ground bearings.

**Tail Stock:** Full bearing spindle running clear through body. Perfect alignment.



**Compound Rest:** Best Gray Iron and Tool Steel. All wearing surfaces ground and fitted to standards. Large graduated friction dials. Taper Gibs.

Sturdiest Lathe for its capacity. Will maintain its accuracy and alignment throughout heavy service. Discriminating shopmen demand the Potter Lathe for its versatility. Designed by toolmakers, embodying all the good points to be found in any bench lathe, with added features comprising (1) Rigidity, (2) Ease of operation, (3) Well balanced design, (4) Interchangeability of all working parts and special fixtures.

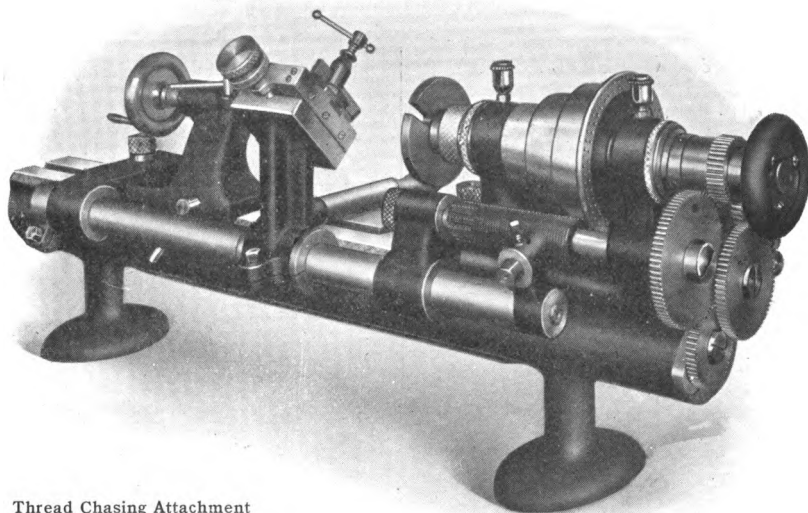
Large production and our organization of specially trained workmen for each unit enable us to turn out a better machine for a moderate price. Quality second to none.

Full line of Attachments and Special Fixtures carried in stock for prompt delivery.



*Thread Chasing Attachments, Manufacturing Combination*

## **S. A. POTTER TOOL & MACHINE WORKS**



Thread Chasing Attachment  
Rear View

### **THREAD CHASING ATTACHMENT:**

The above can be readily attached to all our lathes. No back T-slot or special Headstock required. Will cut any thread up to 3" in diameter by  $4\frac{1}{2}$ " in length. Quicker than an engine lathes within its capacity. No reversing belt needed. Makes an ideal production machine for manufacturing purposes.

The design of this fixture involves a toolpost and slide mounted on a vertical member fastened to the chasing bar, one end of which carries a bronze half-nut engaging in the leader or hob. When end of thread to be cut is reached the tool is raised from the work which also disengages the lead-nut, permitting immediate return to starting position.

### **MANUFACTURING COMBINATION:**

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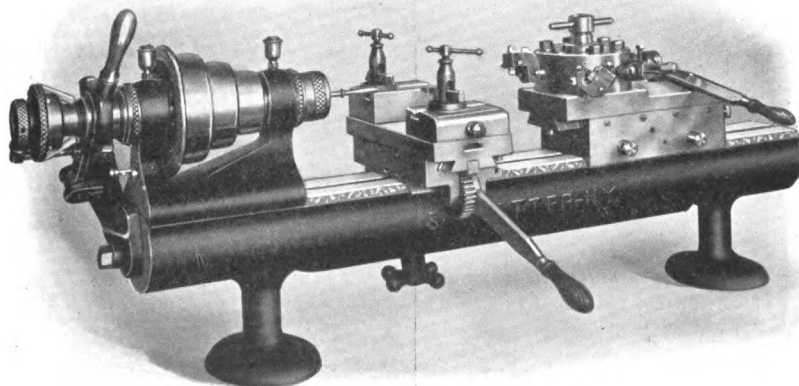
Below is shown our screw machine unit composed of Automatic Chuck-Closer, Double Cross Slide and Six Hole Turret.

Indispensable for precision manufacturing and second operation work following Automatics.

Our Engineering Department is prepared to furnish working schedules and advice on your production work.

*Our Complete Catalogue and Special Bulletins are available upon request.*

*Send for them now.*



Automatic Chuck-Closer, Double Cross Slide and Six Hole Turret

## SMALLEY GENERAL COMPANY, INC.

BAY CITY, MICH.

Manufacturers and Builders of Machinery

**SMALLEY GENERAL THREAD MILLERS** are sturdy, powerful, accurate machines of the highest quality of material and workmanship designed to do the heaviest and most exacting work. Will mill threads with greater accuracy and speed and at lower cost than can be obtained by other methods. Will mill threads with one revolution of the work when multiple tooth hobs are used. The entire lubrication system is of liberal design and reliable. Clean cutting lubricant assured in ample quantities. Fully equipped with grease cups and self-closing oil cups. Belt or motor drive.

changes of threads from the  $3\frac{1}{2}$  per inch up on chucking type.

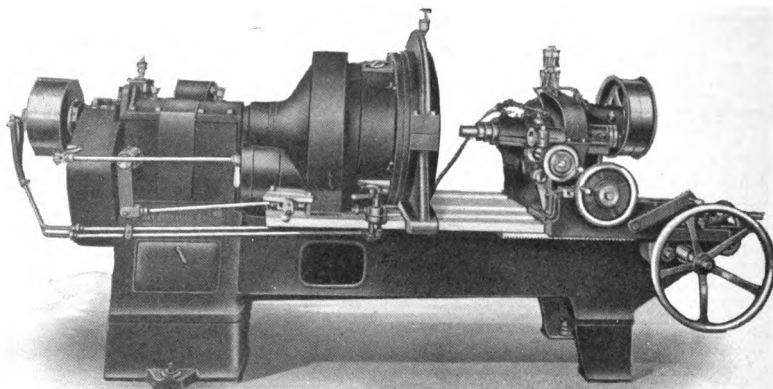
### NO. 23 STANDARD THREAD MILLER:

A single purpose machine for production work; similar to our No. 24 except that it has three turning speeds proportional to three milling speeds.

**Capacity:** 9 in. O. D. and 13 in. I. D., threads with 2 in. diameter hob. 21 changes of threads from  $3\frac{1}{2}$  per inch up on chucking type.

Equipped with hollow spindle for chucking long pieces.

480



Various sizes and types of chucks may be used. Our engineers will recommend methods of chucking.

### NO. 1 THREAD MILLER:

**Capacity:** Made in two sizes: size A, 27 in. by 3 ft. 2 in.; and size B, 27 in. by 4 ft. 8 in. Will mill external, internal, right hand, left hand, straight or taper threads up to 6 in. in length or 16 in. in diameter.

Designed for two speeds, milling or low and turning or high.

### NO. 2 UNIVERSAL AND CHUCKING HOLLOW SPINDLE THREAD MILLER:

Designed for work of larger range and smaller diameter than the No. 1 machine.

**Capacity:** 9 in. O. D., 13 in. I. D., threads with 2 in. diameter hob. 21

### NO. 24 STANDARD THREAD MILLER:

A single purpose machine especially adapted for production work. Designed for three milling speeds only. The machine is the same as our No. 2 except that the gear box and the turning speed clutch are omitted.

**Capacity:** 9 in. O. D. and 13 in. I. D., threads with 2 in. diameter hob. 21 changes of threads from  $3\frac{1}{2}$  per inch up on chucking type.

### SERVICE:

Send us blue print of your threading problems. Actual samples sent at our expense would be still more satisfactory. With preliminary data in hand our Engineering Department would be pleased to give you an accurate time study.

## SLOAN & CHACE MFG. CO., LTD.

OFFICE AND WORKS

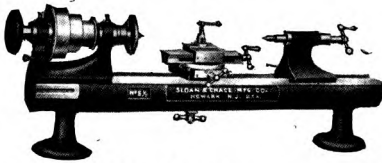
SIXTH AVE., COR. N. 13TH ST., NEWARK, N. J.

Manufacturers of Precision Machinery, Dies and Special Tools

PRODUCTS: Bench Lathes, Bench Milling Machines, Special Machinery, Jigs, Fixtures, Punches and Dies for Sheet Metal, Gauges, Countershafts, Etc.

### NO. 5½ BENCH LATHE:

With Compound Slide Rest



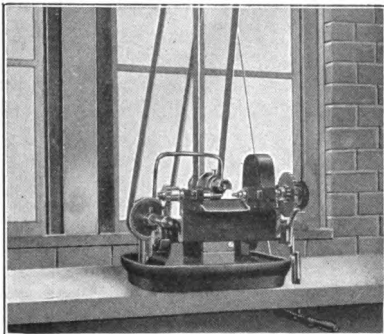
CAPACITY: 7" swing, 18" between centers (bed 35 inches long),  $\frac{5}{8}$ " through draw-in spindle,  $\frac{3}{4}$ " with draw-in spindle removed.

### AUTOMATIC PINION CUTTERS:

CAPACITY: No. 1,  $\frac{3}{4}$ " diameter, 1" face; No. 2, 1" diameter, 1" face.

Automatic Pinion Cutters are built in two sizes, designated as Nos. 1 and 2. The No. 1 machine (illustrated) has a capacity up to  $\frac{3}{4}$ " diameter and 1" face. The No. 2 machine is similar in construction to the No. 1, but larger, and having a capacity for gears and pinions up to 1" diameter and 1" face.

These machines are designed for the rapid production of cut pinions and small spur gears for watches, clocks, meters,

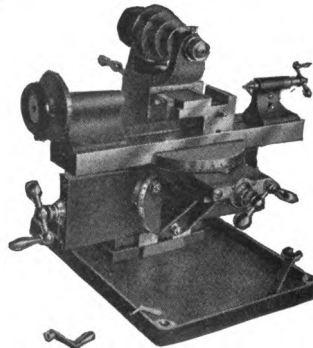


Automatic Gear and Pinion Cutter

etc., and the No. 1 Automatic Gear Cutter will cut brass gears up to  $3\frac{1}{2}$ " diameter.

SPEEDS: Cutter spindle, 1600; worm shaft, 1200; countershaft, 750; cutter feed, 0.07 per revolution.

### BENCH MILLING MACHINES:



Bench Milling Machine

Bench Milling Machine is designed for use in the tool room, or for experimental work, though it is adapted to some classes of manufacturing. It is mounted upon the bench, or a cast iron pedestal 36" high.

### COUNTERSHAFTS:

Suitable Countershafts are provided for all of our many different machines. Lathes are required to perform such a great variety of work and under such varying conditions that we have found it necessary to provide several kinds of countershafts for them. They are Wall or Ceiling Countershafts, both two and three speeds; Wall-Rod Countershafts, one and two speeds; Grinding Countershafts, used with either Wall, or Wall-Rod Countershaft.

We build Special Machinery to individual order, assisting in its development and perfection. Fine Model Making and Gauge Work.

## THE WHITNEY MFG. CO.

HARTFORD, CONN.

Chains—Keys and Cutters—Hand Milling Machines

### **"WHITNEY" TRANSMISSION CHAINS:**

**The Flexibility of Belts**

**The Positive Connection of Gears**



Silent Type

For machine tools, line shafts, factory drives, electric motors, cam shafts, magnetos, lighting systems, generators, pumps, self-starters, etc.

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Roller Type

Used by the leading makers of motor trucks and rendering satisfactory service every day in the year.

*Our engineering department will be glad to assist you to secure maximum efficiency and service.*

### **"WHITNEY" KEYS AND CUTTERS:**

**For the Woodruff System**

Used by the leading builders of automobiles and machine tools where strength,

economy, and absolute interchangeability are a necessity. Our customers state that sometimes it saves as much as 75% over the old method. The operation of cutting the key seat is simple and rapid, and requires no skilled labor.

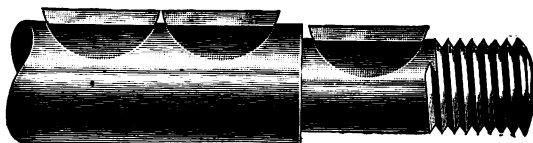
### **THE "WHITNEY" HAND MILLER:**

Is invaluable in the **LARGE FACTORY** as no other design equals it for



big production on interchangeable work, as proved by the thousands of these machines in constant use both here and abroad. One concern alone is using over 800 of these machines and many other concerns have over one hundred each.

Is invaluable in the **SMALL SHOP** as it will handle a wide variety of operations with convenience, accuracy and rapidity. Soon pays for itself.



"Whitney" Keys

# ABRASIVE MACHINE TOOL CO.

F. N. MacLEOD, Pres.

EAST PROVIDENCE, R. I.

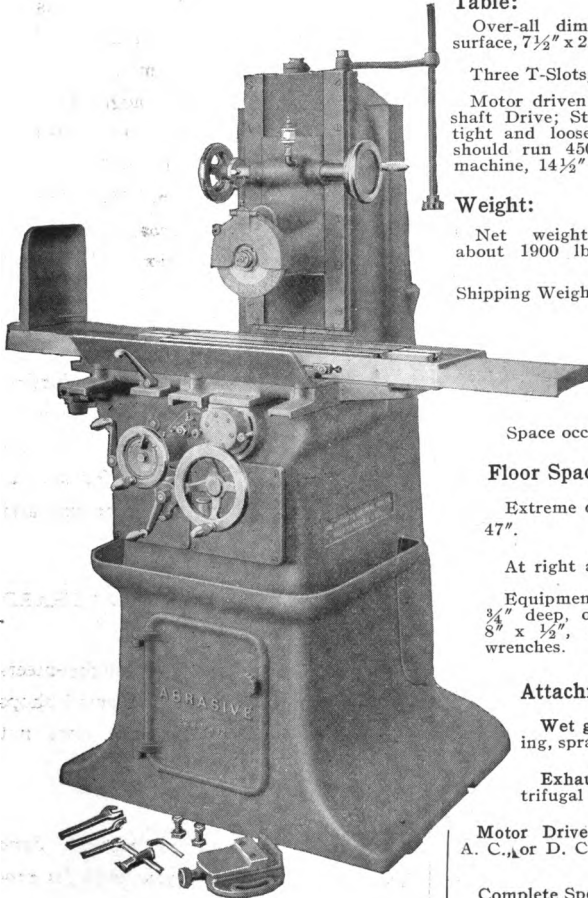
Manufacturers of Precision Grinding Machinery and Index Centers

## ABRASIVE SURFACE GRINDER:

Reasons why you should select the "Abrasive." It is 50% heavier and correspondingly more rigid than other machines of its type, designed so as to practically eliminate vibration. The frame is a ONE-PIECE CASTING, three point support, which means neutralizing torsional strains, retaining alignment and minimizing other stresses.

Emery dust and water are kept from all operating parts by the careful precautionary measures evidenced in the design of the "Abrasive."

Protection to the operator is assured as there are no external moving parts except the emery wheel.



Convenience of control spells contentment to the operative; every wheel and lever is carefully placed in the most natural position.

Built by the unit system of construction. All screws cut to the U. S. Standard Thread system. The customer can make his own repairs.

Extracts from Specifications to show performance, size and equipment.

### Capacity:

22" Longitudinal Feed, automatic.

8" Transverse Feed, automatic.

12" Vertical Hand Adjustment.

Wheels up to 8" diameter by  $\frac{3}{4}$ " thick.

### Table:

Over-all dimensions,  $9\frac{1}{4}$ " x 56". Working surface,  $7\frac{1}{2}$ " x 22".

Three T-Slots,  $\frac{1}{2}$ " wide, are provided.

Motor driven or belt driven. With Countershaft Drive; Steel hangers; ring oiling boxes; tight and loose pulleys 6" for 3" belt, and should run 450 R. P. M. Driving pulley to machine,  $14\frac{1}{2}$ " for 2" belt.

### Weight:

Net weight, countershaft-driven machine, about 1900 lbs.

Shipping Weight { Domestic, about 2200 lbs  
Export, about 2330 lbs.

Export Dimensions,  
 $42$ " x  $50$ " x  $72$ ".

Space occupied, about 88 cubic feet.

### Floor Space:

Extreme dimensions, parallel with spindle, 47".

At right angles with spindle, 78".

Equipment: Adjustable Vise, jaws 4" wide,  $\frac{3}{4}$ " deep, opening 3"; one grinding wheel  $8$ " x  $1\frac{1}{2}$ ",  $1\frac{1}{2}$ " hole; countershaft and wrenches.

### Attachments:

Wet grinding; consisting of pump, piping, spray guards, and nozzle.

Exhauster; consisting of exhauster, centrifugal Dust separator, hood and guard.

Motor Drive; Motor mounted inside base. A. C. or D. C., 1800 r. p. m.

Complete Specifications and descriptive literature sent on request.

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# THE BLANCHARD MACHINE CO.

CAMBRIDGE, MASS.

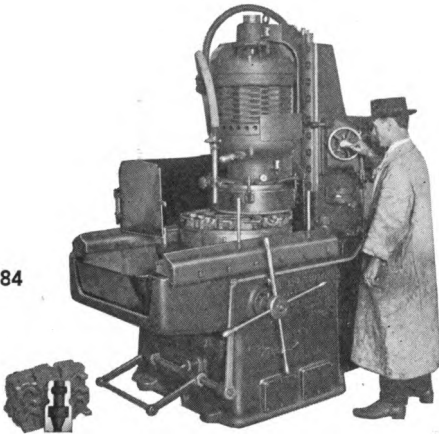
Blanchard High Power Vertical Surface Grinders

Trade  
Mark



Reg.  
U. S.  
Pat.  
Off.

484



Direct Motor Drive Type of No. 16 BLANCHARD GRINDER:

Capacity 30" dia. x 14" high.

Also made in belted motor and countershaft drive types:

Capacity 30" diameter x 12" high.

Flat, accurate, *ground* surfaces furnish locating surfaces for subsequent machining operations, ensure instant, correct alignment in assembling, and present a superior appearance in the completed machine. The advantages of grinding plane surfaces have long been realized but the high cost has prevented the general use of this method of machining.

**THE BLANCHARD HIGH POWER VERTICAL SURFACE GRINDER** was developed to meet the need for an accurate, powerful tool to grind plane surfaces quickly and cheaply and able to finish directly from the rough casting or forging in one operation.

It is today machining plane surfaces on parts for

Airplane Motors	Machine Tools
Automobiles	Ordnance
Ball Bearings	Pumps
Compressors	Phonographs
Diesel Engines	Steam Engines
Electrical Apparatus	Sewing Machines
Gas Engines	Shoe Machinery
Jigs and Fixtures	Small Tools
Linotypes	Textile Machinery
Locomotives	Tractors
	Turbines

in hundreds of shops at a **great reduction in cost over former methods**. Numerous repeat orders from firms who have used BLANCHARD GRINDERS for several years past testify to their economy and sustained accuracy.

## THE NEW NO. 10 BLANCHARD GRINDER:

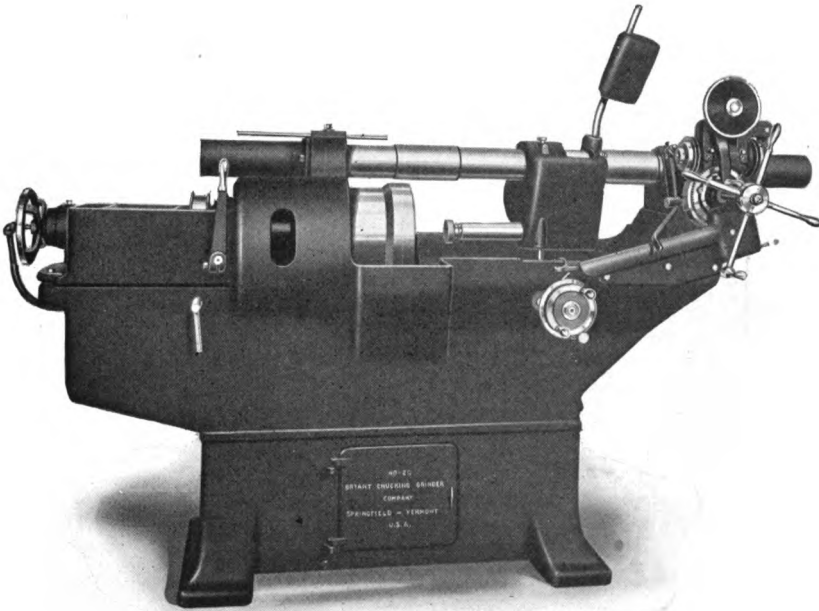
Capacity 18" diameter x 6" high—meets the needs of tool rooms and small shops where the quantity of work does not warrant the larger machine.

*Descriptive catalog on request. Send blueprints or samples of your work for production estimates.*

# BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of Chucking or Internal Grinders



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**No. 20 Deep Hole Grinder for Single Unit Automobile and Aeroplane Motor Cylinders, Valve Sleeves, Hammer Barrels, Die Rings and Sleeves, etc.**

## SPECIFICATIONS OF BRYANT SEMI-AUTOMATIC HOLE GRINDERS

	No. 6	No. 10	No. 18	No. 20	No. 30
Chuck Range....	12 $\frac{5}{8}$ "	12 $\frac{5}{8}$ "	27 $\frac{3}{4}$ "	12 $\frac{3}{4}$ "	30"
Maximum Wheel					
Slide Traverse.	8"	14 $\frac{1}{4}$ "	11 $\frac{1}{2}$ "	14 $\frac{1}{4}$ "	14 $\frac{1}{4}$ "

Grinders Numbers 10 and 30 are furnished with two-spindle wheel slides for hole and face grinding. This makes

it possible to make the two operations at a single holding of the work and insures accuracy for finished surfaces.



## LANDIS TOOL COMPANY

WAYNESBORO, PA.

NEW YORK OFFICE: 50 Church St.

**Manufacturers of Precision Cylindrical Grinding Machines**

Our regular line consists of the following types:

**UNIVERSAL MACHINES:** No. 1, No. 1½, No. 2, No. 3, No. 4 are used for finishing tools and a variety of straight or taper parts, both external and internal, such as are common to the tool room, machine shop, railroad shops, etc.

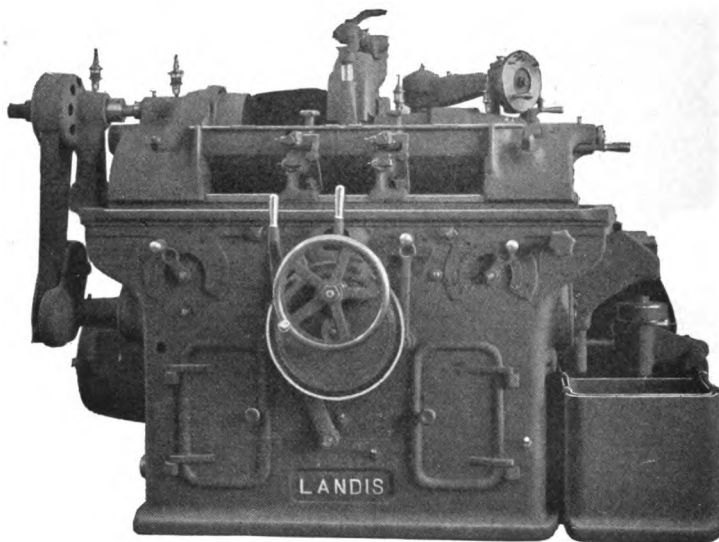
Attachments, such as magnetic chuck, gear-cutter attachment, side mill grind-

and the fixtures for these machines will grind holes  $\frac{1}{4}$ " in diameter, or larger, and up to 12" long.

**CRANK GRINDING MACHINES:** for grinding single or multiple throw crank shafts used in gas and small steam engines.

**ROLL GRINDING MACHINES:** for grinding chilled iron and hardened steel rolls.

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**Improved Self-Contained Grinding Machine**

ing attachment, etc., can be used on these machines to advantage.

**PLAIN GRINDING MACHINES:** Sizes 6", 10", 12", 20", 30", 40" swings in standard lengths. These strictly manufacturing machines are intended for finishing straight and taper spindles, shafts, rolls, tubing and all other work which can be revolved on dead centers.

**PLAIN GRINDING MACHINES WITH GAP:** are our 20" swing Plain Machines, built with gap in the bed to suit the location of the projection on the work. Especially suitable for grinding locomotive piston rods.

**INTERNAL GRINDING MACHINES:** for straight and taper internal grinding

**CAM GRINDING ATTACHMENTS:** (for use on our plain and universal grinders) for grinding either detachable or integral cams.

**BALL BEARING RACE GRINDING MACHINES:** for grinding the raceways in radial, thrust and cone ball bearings.

**LANDIS**

Our illustrated and descriptive catalogues and literature give detailed information. They also describe the features which stand for quick manipulation, accurately finished work, durability of alignments and rapid production—all of which are prominent in the various types of Landis Grinding Machines.



## LANSING STAMPING AND TOOL CO.

LANSING, MICHIGAN

**Manufacturers of Metal Stampings, Steel Products, Dies, Tools, The Capital  
Internal Grinder**

### PRESSED METAL PARTS:



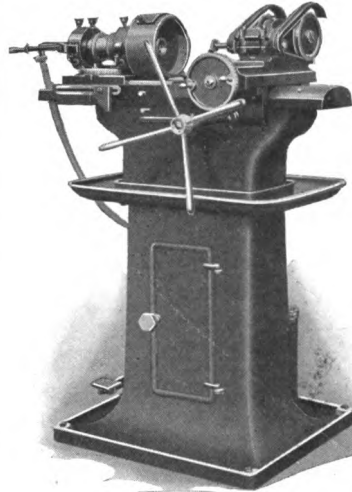
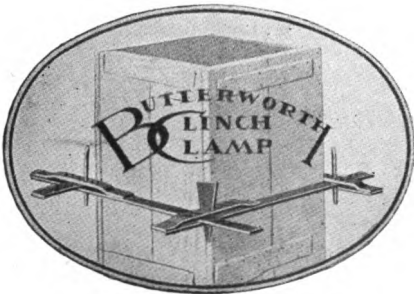
Dies—Tools—Jigs: We are equipped to make both Light and Heavy Stampings in large quantities complete to blue print including Heat Treating, Spot Welding, Pickling, Enameling and Machining. Send us your specifications for estimate.



### BUTTERWORTH CLINCH CLAMPS FOR CONCRETE COLUMNS:

Pronounced by its many users to be the most adjustable, serviceable and durable clamp in use to-day.

May we write you in detail about this device?



487

### CAPITAL INTERNAL GRINDER:

The most nearly automatic hand operated machine of its kind on the market to-day.

Its labor-saving devices are highly developed, leaving the production possible entirely to the alertness of the operator.

All spindles are mounted in SKF self-aligning dust-proof ball bearings.

This bearing arrangement insures extreme accuracy.

*Write for Bulletin No. 2.*

## MACHINERY COMPANY OF AMERICA

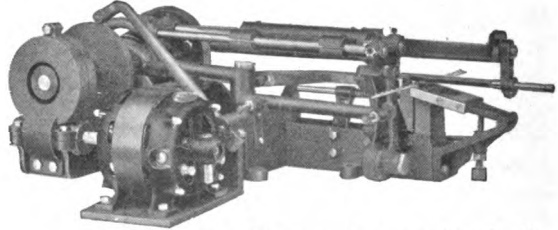
BIG RAPIDS, MICH., U. S. A.

Manufacturers of Saw and Knife Fitting Machinery and Tools

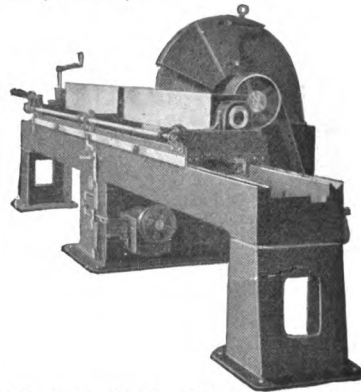
### **AUTOMATIC MACHINES FOR ALL SAW AND KNIFE FITTING RE- QUIREMENTS, SHEAR BLADE GRINDING, ETC.:**

For all classes of saws, knives, shear blades and metal plates, as employed in wood working factories, saw mills, steel plants, car shops, and all classes of industry employing wood or metal working saws, knives, shear blades, etc.

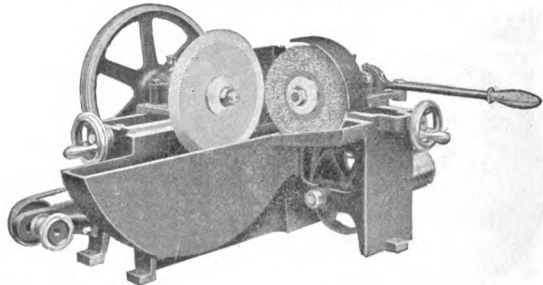
Grinding Wheel  
Dressers.



Motor Driven Narrow Band Saw  
Filers, Setters, etc.

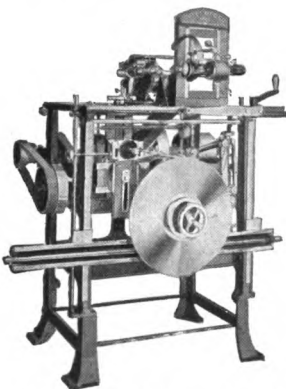
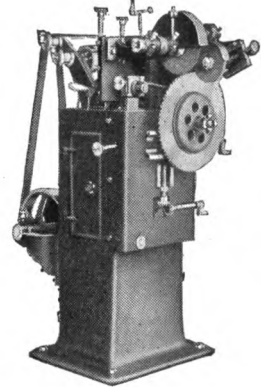


Straight & Cup Wheel Grinders from  
200 lbs. to six ton weight, for all classes  
of knives, shear blades, etc.



Circular Knife and Cutter Grinders.  
*Write for Catalog—Dept. G.*

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Automatic Sharpeners (il-  
lustrated above) for Hot and  
Cold Saws for Metal Cutting,  
Slitting and Milling Cutters,  
Brown & Sharpe or Cochran-Bly Alter-  
nating Tooth Cutters.

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# NORTON GRINDING COMPANY

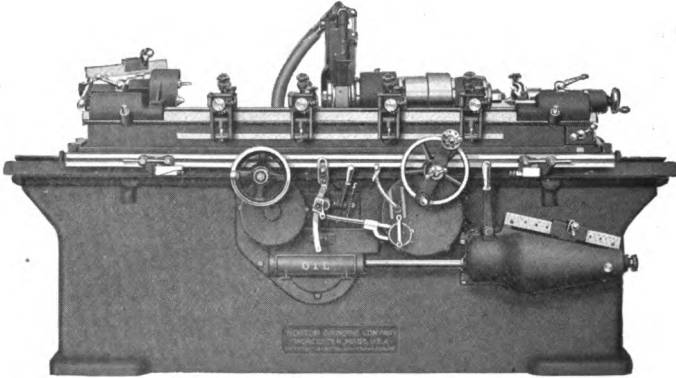
WORCESTER, MASS., U. S. A.

*Cable Address: "GRINCO"*

A. B. C., Lieber's, Business, New Business and Western Union Codes

**Manufacturers of Grinding Machinery**

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## **PLAIN MACHINES FOR CYLINDRICAL GRINDING:**

SWING—3"—6"—10"—14"—16"—18"—20"—22"—24"—26", and of VARIOUS LENGTHS between centers.

## **SURFACE GRINDING MACHINES:**

WIDTH OF TABLE—15", distance between wheel and table 15".

LENGTH OF TABLE—6'—8'—10'—12'—14'.

## **CRANKSHAFT GRINDING MACHINE:**

## **UNIVERSAL TOOL AND CUTTER GRINDING MACHINES:**

SIZE No. 1. CAPACITY 8" or 10", SWING 15" between centers.

SIZE No. 2. CAPACITY 10" or 12", SWING 32" between centers.

## **ROLL GRINDING MACHINES:**

**489**

BUILT TO ORDER.

## **CAR WHEEL GRINDING MACHINES:**

For grinding mounted car wheels while revolving on their own journals.

## **RUNNING BALANCE INDICATING MACHINES:**

This machine is made for locating errors in running balance of revolving parts. Particularly adapted for automobile crankshafts, fly-wheels and clutches. Also armatures for small motors.

*Send for Illustrated Literature.*

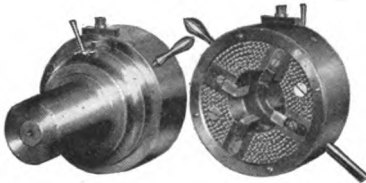
## MODERN TOOL COMPANY

ERIE, PENNA., U. S. A.

**Manufacturers of Self-Opening Dies, Hollow Milling Tools, Solid Dies, Quick Change Chucks and Chaser Grinders**

### "MODERN" SELF-OPENING DIES:

"Modern" Threading Tools are universal in their application and use, being adapted for revolving spindles as well as turret lathes and screw machines. A single style of Die will cut any form or pitch of thread, of any diameter within the capacity of the respective heads.



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"Modern" Die Heads are made in sizes to thread any diameter from  $\frac{1}{16}$ " to 7".

### "MAGIC" CHUCK EQUIPMENT:

For the rapid changing of tools in drill press, lathe, screw machine, etc., without stopping the machine, practically converting a single spindle machine into a multiple spindle one, with as many tools as you may have operations. Made in six sizes, the largest with capacity up to 5" diameter drills. Try it and save labor costs.

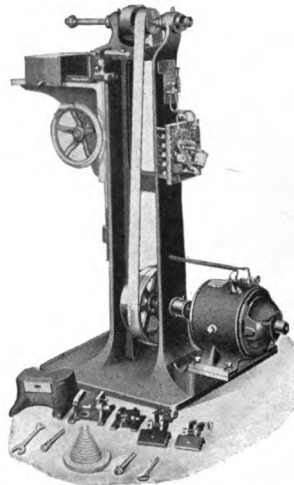


"Magic" Chuck and Collets

### "MODERN" CHASER GRINDERS:

To all users of threading dies who value accuracy and correctness in gauge of threads, we recommend the use of machine ground chasers or threading dies.

The "Modern" Chaser Grinder was especially designed for grinding chasers of the "Modern" Die Head, but is equally efficient for chasers of any style or make of die, providing the chasers have parallel sides. We also furnish a number of special fixtures with this machine, by the use of which Spring Dies, Pipe Dies, Reamers, Spiral and End Mills, Milling Cutters, etc., may be successfully ground to advantage.



Modern Chaser Grinder

This machine is simple in construction, inexpensive to maintain, easy to operate and it will save much valuable time in the grinding of your small tools.

Modern Chaser Grinders are made for belt drive or a complete motor driven unit.

## MODERN TOOL COMPANY

ERIE, PENNA., U. S. A.

DISTRICT OFFICES: NEW YORK, CHICAGO, DETROIT, CINCINNATI AND CLEVELAND  
Rudel-Belnap Machinery Co., Montreal and Toronto, Canada  
Leo C. Steinle, 53 Victoria St., London, S. W., England  
H. Miguel Mateu, Barcelona, Spain  
Rylander & Asplund, Stockholm, Sweden

Manufacturers of "MODERN" Cylindrical Grinding Machines

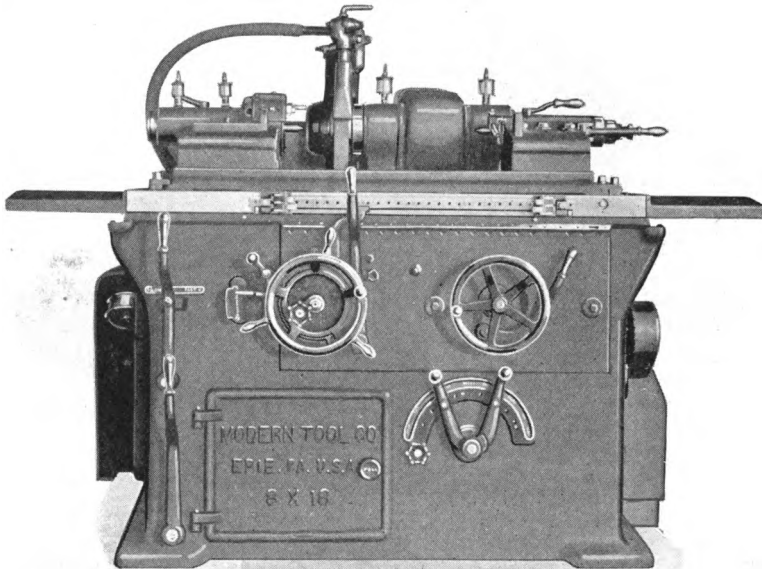
### PLAIN SELF-CONTAINED GRINDING MACHINES:

Sizes 8"-12"-16" swings; 18"-24"-30"-36"-48"-60" between centers.

shaft equipped with roller bearings throughout.

### INTERNAL GRINDING MACHINE:

Swings 10", grinds 10" deep—a manufacturing machine designed for grinding



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8" x 18" Self-Contained Plain Grinding Machine

These machines have a single constant speed drive, which reduces the cost when equipping the machines with motors. The main drive is in the rear of the machine and power is applied either from the line shaft by a single belt or by motor connection.

### UNIVERSAL GRINDING MACHINE:

External and Internal in combination. Capacity 13" swing, 40" center distance. For the tool room or machine shop, with many advantages for manufacturing—and improved operative features; counter-

all varieties of gears, sleeves, cutters, collets, bushings, cam rings, valves, roller bearings and work of a similar class.

The above types are strictly manufacturing machines, designed to withstand the class of service required of grinding machines of this character, and embody many new and improved features which enable them to produce accurate, highly finished parts, rapidly and economically.

*Send for illustrated literature.*

## JOSEPH T. RYERSON & SON

Established 1842

Incorporated 1888

CHICAGO

NEW YORK

ST. LOUIS

DETROIT

### HIGH SPEED FRICTION SAWS:

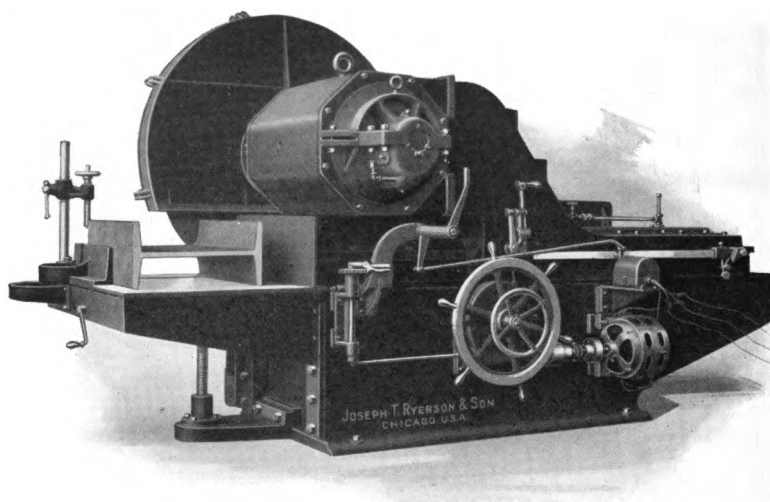
The leading Mechanical Engineers and Shop Managers acknowledge the many advantages which the High Speed Friction Saw has compared with slow speed cold saws and beam shears. This is evidenced by the installations in many large shops throughout the country.

### The Machines Are Made in Four Sizes

- No. 1 Capacity, 12" Beam sections
- No. 2 Capacity, 18" Beam sections
- No. 3 Capacity up to 24" Beam sections
- No. 4 Capacity, The heaviest sections rolled including Bethlehem Sections

These machines will also cut various other structural shapes and bars with equivalent cutting area.

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**Uses:** The Ryerson High Speed Friction Saw is being used by the leading bridge and structural plants in this country and abroad, by shipbuilding plants in the cutting to length of structural shapes and by frog and switch manufacturers, and the railroads are likewise using the saw in reclamation work of old rail sections.

In addition to the above classes of cutting work this saw will cut round and square bars when used with the Ryerson Patented stock chucking and rotating device.

**Time Saving:** The Ryerson High Speed Friction Saw will cut material in a small fraction of the time required in cutting by any other means. The average time for cutting, when all sections are considered, is less than 40 seconds per cut. Rails, Beams, Angles, Channels and Bars, etc., may be cut in immediate succession without any adjustment of the machine.

**Power Consumption:** Entire absence of belts, gears, fly wheels, etc., permits operation at the highest efficiency and at much less expense than other machines of same capacity.

*Marking Machines, Grinding Machines, Die Cutting*

## NOBLE & WESTBROOK MFG. CO.

HARTFORD, CONN, U. S. A.

**Manufacturers of Dwight Slate Marking Machines, Marking Devices of Every Description, Expert Die Cutting and Engraving, Filing Machines, Grinding and Polishing Machines**

**DWIGHT SLATE MARKING MACHINE**

**These Machines Will Mark Artistically  
Any Article or Any Material Suitable  
for Impressions.**



**Hand or Power Machines Recommended**

A specialty of our line of manufacture is the making of devices and machines for placing on flat or round metal surfaces, impressions of trade-marks, patent dates, graduated scales and a variety of similar work. These machines are not expensive, are adapted to the work, do it in a superior manner at less cost than is possible on any makeshift devices.

A neat mark is desirable, adds to appearance of goods, and is a feature that the manufacturer cannot afford to ignore. Goods of all kinds are put on the market in more tasty and improved form than a few years since. Both trade and purchasers call for these qualities. Antiquated and clumsy designs that were "good enough" are rapidly being displaced by improved forms and finish. By using modern machinery this is done at saving of original cost; therefore, when

we offer better work at less cost we ask its consideration. Samples or sketches of work are solicited, proper machines recommended, and complete outfits furnished.

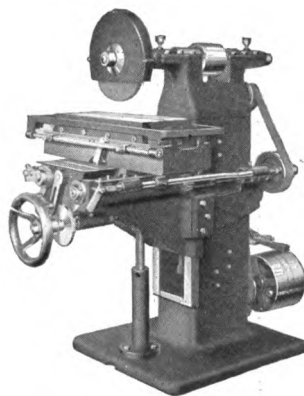
### **DIE CUTTING BY EXPERT ENGRAVERS:**

**For These Machines a Specialty**

We have a large force of expert engravers familiar with the die cutting for these machines, and in order to get the best results we would recommend that you send us samples and let us furnish you the first equipment of dies and fixtures.

### **GRINDING AND POLISHING MACHINES:**

The new Noble & Westbrook Automatic Surface Grinder, furnished with or without magnetic chuck, is dust-proof, has feed dials graduated to .001", and has a capacity of 8" x 20". All slides and spindles are adjustable for wear.



**Automatic Surface Grinder**

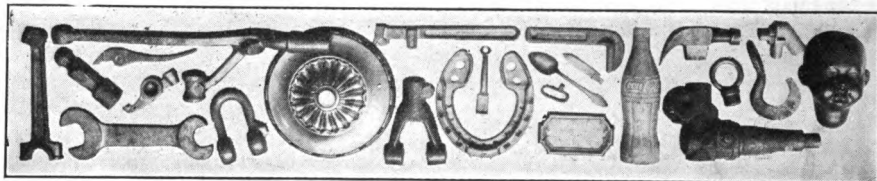
*Catalog gives complete details.*

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*Die Sinking Machines*

## KELLER MECHANICAL ENGRAVING CO.

68 WASHINGTON ST., BROOKLYN BORO, NEW YORK CITY, U. S. A.



**AUTOMATIC DIE SINKING MACHINES** of many types, [to meet a great variety of conditions and requirements.

With the constantly increasing demand for **DIES** and **MOULDS** the supply of skilled labor has become entirely inadequate.

Keller Machines have solved this problem for industries requiring **FORGING** and **STAMPING DIES**. They are in use in the leading Drop Forge plants in America and Europe.

Thousands of forging dies for Rifle and Automobile Components, Tools, Railroad and Marine Work, etc., are being turned out by this method.

The Keller Method is successfully employed in industries producing

Automobiles

Marine Hardware

Small Arms (Rifle, Machine Guns, etc.)

Scissor, Shear, Manicure Goods and

Surgical Instruments

Cutlery

Wrenches

Small Tools

Sporting Goods

Saddlery and Harness Hardware

Silver and Plateware (Flat and Hollow)

Glass Bottles

Rubber (Hard and Soft)

Rubber substitutes, Compositions and Plastic Materials (Celluloid, Bakelite, etc.)

Ball Bearings

Horse Shoes

Brass Goods

Die Castings

Glass Ware

Builders' Hardware

Trunk Hardware

Medals and Badges

Jewelry

Typewriters

Sewing Machines

Stamps, letters and figures

Steel Brands

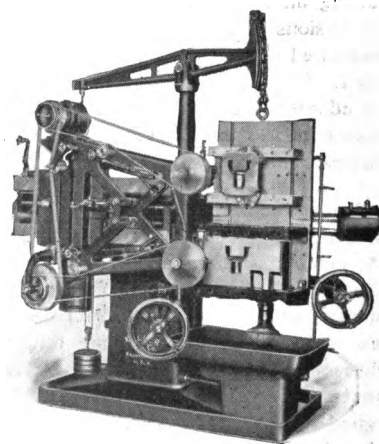
Wagon and Carriage Hardware

Valves

Chocolate Moulds

Also in Railroad Shops and Car Works

Arsenals and Navy Yards



TRADE

**KME** MARK



Electric Drills, Gears, Gear Cutting

# THE VAN DORN ELECTRIC TOOL CO.

Electric Tool Specialists

# THE VAN DORN AND DUTTON CO.

Gear Specialists

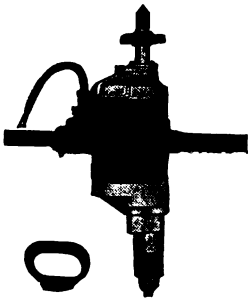
GENERAL OFFICES AND FACTORIES

CLEVELAND, OHIO

*The erection of big new factories equipped with the latest machinery gives both Van Dorn companies excellent facilities for supplying the demand for their respective products.*

*"Van Dorn"*

## "HARD SERVICE" (PORTABLE) ELECTRIC DRILLS AND REAMERS:



Made in various speeds for rapid production on bridge structural and car reaming, general drilling, etc.

110-, 115-, 220-, and 230-volt machines carried in stock.

The motors employed are of the straight series type, designed to withstand a 50% overload. Ball bearings are used on both ends of the armature shaft, ball type thrust bearings, hardened and ground gears with accurately generated teeth, quick make-and-break switches, and forced lubrication in lower head.

### DIRECT CURRENT MACHINES

Type	Code	R.P.M.	Drilling Capacity	Reaming Capacity	Weight in Lbs.
D. C. 1	B-3600	550	1 1/2"	1 1/2"	27
D. C. 2x	A-2100	600	1 3/8"	1 3/8"	28
D. C. 2	20,100	575	1 3/8"	1 3/8"	45
D. C. 3	20000	700	1 1/2"	1 1/2"	49
D. C. 4	1500	500	1 1/2"	1 1/2"	80
D. C. 4	A-1600	600	1 1/2"	1 1/2"	86
D. C. 5	2800	300	2"	2"	107
D. C. 5	A-9200	425	2"	1 5/8"	125

Supplied with cable ready to attach to line. 1/2" machines supplied with chucks when wanted. 3/4" machines and larger equipped with Morse taper sockets.

We also carry in stock universal machines for operation on D. C. and A. C. in 1/4", 5/16", 3/8", 1/2", 5/8" and 3/4" capacities.

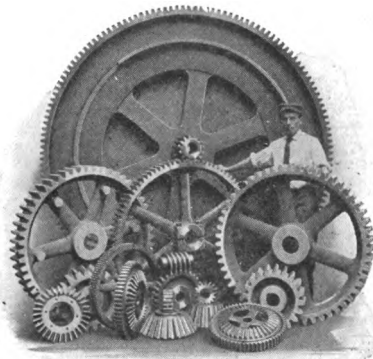
*"Van Dorn"*

## GEARS AND GEAR CUTTING:

The Van Dorn & Dutton Co. specialize in gearing and are prepared to furnish complete, machine complete, or cut only—to your specification—gears of all descriptions, for every class of service.

Our output includes spurs, bevels, spiral bevels, mitres, spirals, worms, racks, sprockets, Bakelite Micarta-D and rawhide pinions etc.

495



An enlarged hardening and steel-treating plant is one of the features behind "Van Dorn" quality.

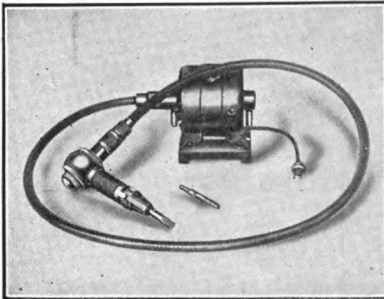
# TITAN AUTOMATIC TOOL CO., INC.

25 WEST BROADWAY, NEW YORK

Manufacturers of TITAN Universal, Single Unit, Pneumatic TOOLS, "Seabolt" Gauges, Measuring Wires, Etc.

TITAN Universal, Single Unit, Pneumatic TOOLS are self-contained, electrically driven pneumatic hammers, simple in construction, durable, portable, new in principle and revolutionary in performance.

They are made in FIVE SIZES and are, therefore, applicable to a wide range of uses.



Size No. 3 for Tool and Die Makers

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Uses of TITAN Universal, Single Unit, Pneumatic TOOLS:

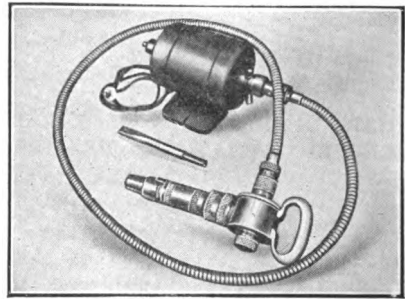
- Engraving, hammering and chasing for jewelers and metal crafters.
- Wood carving.
- Die sinking and die making.
- Facing, cutting and lettering stone.
- Chipping, trimming and cutting of all kinds of metal castings and pipe.
- Chipping, trimming, cutting and beading of boiler plates; auto and truck bodies, frames, cabs, etc.
- Calking boilers, caissons, tanks, pipe joints, etc.
- Scaling ships, boilers, painted and rusted surfaces, picking and drilling concrete, coal or asphalt.
- Driving and clinching drift bolts and spikes.
- Riveting structural shapes, plates and sheets.
- Scraping and oil grooving of bearings.

TITAN Universal, Single Unit, Pneumatic TOOLS show the maximum of efficiency under the most severe and varied conditions and are superior to any pneumatic or electric hammers

on the market to-day for the majority of applications.

Advantages of TITAN Universal, Single Unit, Pneumatic TOOLS:

1. Low first cost—Prices \$50.00 to \$250.00 for a complete unit ready to use.
2. Low maintenance cost—Replacement of



Size No. 9 for Heavy Chipping and Riveting

parts practically nil; no auxiliary equipment needed.

3. Low operating cost  $\frac{1}{30}$  to  $\frac{1}{2}$  H. P. per unit.
4. Simplicity—No complicated, numerous or breakable parts; only 13 sturdy parts in all, only 7 of which are moving, working parts.
5. No air compressor, expensive installation or piping.
6. No electric parts in tool to cause sparking, circuit breaking or burning-out troubles due to sticking—only a standard, well-built efficient motor as on outside power plant which no overload on the tool can stall.
7. No valves to clean and pack.
8. Ease of control—Force of blow is regulated by simply varying the degree of body or muscle pressure on the tool.
9. Wide range of adaptability—Five sizes, from a delicate engravers' tool to a heavy sturdy tool for iron and steel shipping, riveting and rock drilling.
10. Universal use—By means of attachments for drilling, grinding, polishing and scraping.
11. Portability.

## STANDARD SIZES, CAPACITIES, USES, PRICES, ETC.

Size No.	Principal Uses	No. Blows per Min.	Approx. Power of Blow Lbs.	H. P. of Motor	Size of Tool Bushing	Total Weight Pounds	Price Complete with Motor, Flexible Shaft and Two Tool Points
2	Engraving, metal chasing	4500	4	$\frac{1}{30}$	$\frac{3}{32}$ Rd.	5	\$50.00
3	Die sinking, wood carving, bearing, grooving and scraping.....	4000	6	$\frac{1}{20}$	$\frac{1}{4}$ Hex.	10	75.00
4½	Stone cutting, facing and lettering.....	3500	10	$\frac{1}{8}$	$\frac{3}{8}$ Oct.	20	100.00
6	Medium, calking, chipping, beading, scaling and riveting.....	2000	15	$\frac{1}{6}$	$\frac{1}{2}$ Oct.	40	170.00
9	Heavy chipping, drilling, picking and riveting...	1800	40	$\frac{1}{2}$	$\frac{3}{4}$ Oct.	60	250.00

Standard Equipments are for 110 Volts D. C. and 110 Volts A. C., 60 Cycle Single Phase. Other Voltages and Types of Current to Order. Complete Catalog on Request

# TITAN AUTOMATIC TOOL CO., INC.

25 WEST BROADWAY, NEW YORK

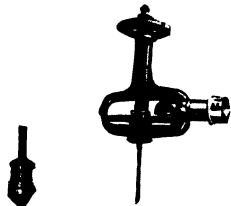
Manufacturers of TITAN Universal, Single Unit, Pneumatic TOOLS, "Seabolt" Gauges, Measuring Wires, Etc.

The Accessories and Tool Points illustrated below are used with the various sizes of

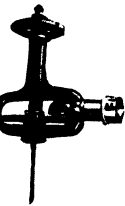
TITAN Universal, Single Unit, Pneumatic TOOLS.



Grinding and Polishing Attachment for Nos. 6 and 9 Motor and Flexible Shaft



Rivet Set for Nos. 6 and 9 Titan Tools



Drilling Attachment for Nos. 6 and 9 Motor and Flexible Shaft



Tool Points for Nos. 2, 3, 4½, 6 and 9



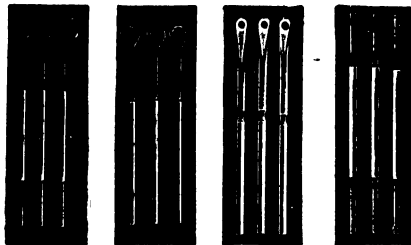
Hand piece to fit motor and shaft No. 3 for die sinking burs, bearing scraping burs, grinding, cutting and polishing wheels



Wood Carvers with Adapter for No. 3



Graver Points for No. 2



497

"Seabolt" standard measuring wires of supreme accuracy for determining angle and pitch of threads



"Seabolt" Standard Tolerance Plug Gauge



"Seabolt" Standard Tolerance Thread Gauge

Also ring gauges, special gauges and measuring blocks.

Complete catalog on request.



## LANDIS MACHINE CO., INC.

WAYNESBORO, PA., U. S. A.

**Manufacturers of Bolt Threading, Bolt Pointing, Nut Tapping, Pipe and Nipple Threading and Pipe Threading and Cutting Machines; Screw Cutting Die Heads and Chaser Grinder**

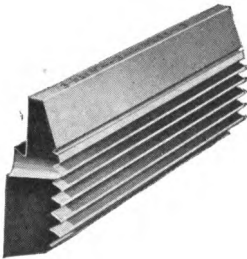
### THE LANDIS CHASER:

The design of the Landis chaser is entirely different from any other type of die and it embodies features which insure a high production of clean-cut, well-formed threads at a minimum cost of die maintenance.

### Distinctive Features of the Landis Chaser

Its length is such as to give a life many times that of any other die. It has a variable rake angle which permits of a grinding suitable for the material being threaded. It has a line contact with the stock, thereby reducing the friction to a minimum and permitting of exceptionally high cutting speeds. The throat or bevel is permanent, insuring close shoulder work at all times. The chasers are interchangeable to the extent that any one or more of a set can be replaced without renewing the entire die. The chaser is milled and hardened its entire length, eliminating the necessity of annealing hobbing and re-

498



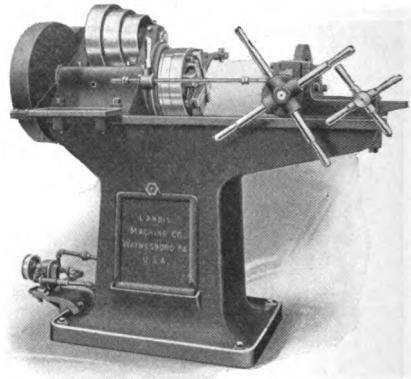
tempering. The chaser is sharpened by merely grinding it at the end. High speed steel can be used to better advantage than in any other type of die.

### THE LANDIS DIE HEAD:

The die head is made entirely of steel. It has a diametrical adjusting mechanism which permits of a universal adjustment. The head is provided with an automatic opening and closing device which derives its action from the forward and backward travels of the carriage. This device is located within the head and carries all the cutting strain. It also serves to lock the head, relieving the yoke of this duty. The head is graduated both right and left hand for all sizes within its range.

### THE LANDIS BOLT THREADING MACHINE:

The Landis Bolt Threading Machine is designed to give economical service and accurate results. The frame is cast in one piece. An excellent die lubricating system insures a sufficient flow of lubricant at all times. The carriage is gibbed to the bed to compensate for any wear. The vises have a horizontal sidewise, as well as a vertical centering adjustment, permitting a perfect and permanent alignment with the die. All gears are enclosed to provide for the safety of the operator.



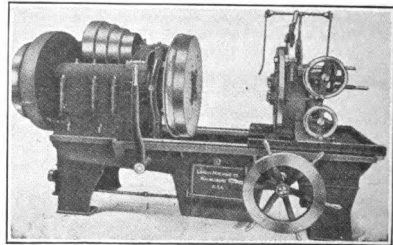
### THE LANDIS PIPE AND NIPPLE THREADING MACHINE:

The Landis Pipe and Nipple Threading Machine is similar in design to the Bolt Threading Machine. It is equipped with a reaming device which removes the burr which forms during the cutting-off operation, while the pipe is being threaded. Nipple grips are provided with both plain and threaded surfaces to receive the blank and threaded pipe ends.

### THE LANDIS PIPE THREADING AND CUTTING MACHINE:

The Landis Pipe Threading and Cutting Machine employs a stationary type die head. The entire range of each head with the exception of the 2" size is covered by but one set of chasers. The head is manually operated and under working conditions is locked within itself.

The machine is rigid in construction and its design embodies all features to facilitate production and to insure safety for the operator. The carriage supports the head, cutting-off tools, reaming device, and length gauge, all located conveniently for efficient service.



Catalogue No. 24—Bolt Threading Machinery.

Catalogue No. 25—Pipe Threading Machinery.

and Pipe Threading and Cutting Machines. Die Heads

# LANDIS MACHINE CO., INC.

## SPECIFICATIONS OF STANDARD BOLT THREADING MACHINES

Type	Size	Range	Chaser Equipment Inches	R. P. M. Countershaft		Floor Space Required	Approx. Net Weight Lbs.
				Carbon Steel	H. S. Steel		
Single Head Machines	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	1 set each of $\frac{1}{4}$ , $\frac{1}{8}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , and $\frac{1}{8}$ .	180	300	1' 9"x4' 1"	850
	$1\frac{1}{4}$ "	$\frac{1}{2}$ " to 1"	1 set each of $\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ & 1.	200	300	2' 3"x4'11 $\frac{1}{2}$ "	1350
	$1\frac{1}{2}$ "	$\frac{3}{8}$ " to $1\frac{1}{4}$ "	1 set each of $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1, $1\frac{1}{8}$ and $1\frac{1}{4}$ .	300	450	2' 3"x4'11 $\frac{1}{2}$ "	1400
	$1\frac{1}{2}$ "	$\frac{1}{2}$ " to $1\frac{1}{2}$ "	1 set each of $\frac{3}{8}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , and $1\frac{3}{4}$ .	280	400	2' 3"x4'11 $\frac{1}{2}$ "	1400
	2"	$\frac{1}{2}$ " to 2"	1 set each of $\frac{3}{8}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , and 2.	225	400	2' 8"x7' 1 $\frac{1}{2}$ "	2200
	$2\frac{1}{2}$ "	$\frac{3}{4}$ " to $2\frac{1}{2}$ "	1 set of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , 2, $2\frac{1}{4}$ , and $2\frac{1}{2}$ .	300	500	2' 8"x7' 1 $\frac{1}{2}$ "	2300
	$2\frac{1}{2}$ "	$\frac{3}{4}$ " to $2\frac{1}{2}$ "	1 set each of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{4}$ , $1\frac{3}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{3}{4}$ , and $2\frac{1}{2}$ .	300	500	2' 11"x8' 3 $\frac{1}{2}$ "	3000
	Long Bed	1" to 3"	1 set each of 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{4}$ , $1\frac{3}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{3}{4}$ , and 3.	300	500	3' 7"x9' 1"	4200
	$3\frac{1}{2}$ "	1" to $3\frac{1}{2}$ "	1 set each of 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{4}$ , $1\frac{3}{8}$ , $1\frac{1}{2}$ , $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{3}{4}$ , $2\frac{1}{2}$ , $2\frac{3}{4}$ , 3, $3\frac{1}{4}$ , and $3\frac{1}{2}$ .	300	500	3' 7"x9' 1"	4400
	4"	$1\frac{1}{2}$ " to 4"	1 set each of $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , 2, $2\frac{1}{4}$ , $2\frac{1}{2}$ , $2\frac{3}{4}$ , 3, $3\frac{1}{4}$ , $3\frac{1}{2}$ , $3\frac{3}{4}$ , and 4.	300	500	3' 7"x9' 1"	4550

Double Head Machines	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	2 sets each of $\frac{1}{4}$ , $\frac{1}{8}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , and $\frac{1}{8}$ .	180	300	2'10 $\frac{1}{2}$ "x4' 1"	1400
	$1\frac{1}{4}$ "	$\frac{1}{2}$ " to 1"	2 sets each of $\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , and $\frac{3}{4}$ , and 1 set each of $\frac{3}{8}$ , and 1.	200	300	3' 6"x4'11 $\frac{1}{2}$ "	2250
	$1\frac{1}{2}$ "	$\frac{3}{8}$ " to $1\frac{1}{4}$ "	2 sets each of $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , and $\frac{7}{8}$ , and 1 set each of 1, $1\frac{1}{8}$ , and $1\frac{1}{4}$ .	300	425	3' 6"x4'11 $\frac{1}{2}$ "	2350
	$1\frac{1}{2}$ "	$\frac{1}{2}$ " to $1\frac{1}{2}$ "	2 sets each of $\frac{3}{8}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , and 1, and 1 set each of $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , and $1\frac{3}{4}$ .	280	400	3' 6"x4'11 $\frac{1}{2}$ "	2400
	2"	$\frac{1}{2}$ " to 2"	2 sets each of $\frac{3}{8}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , and 1 set each of $1\frac{1}{8}$ & 2.	225	400	4' $\frac{1}{2}$ "x6' 4 $\frac{1}{2}$ "	3800
	$2\frac{1}{2}$ "	$\frac{3}{4}$ " to $2\frac{1}{2}$ "	2 sets each of $\frac{3}{4}$ , $\frac{1}{2}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , and 2, and 1 set each of $2\frac{1}{4}$ and $2\frac{1}{2}$ .	300	500	4' $\frac{1}{2}$ "x7' 1 $\frac{1}{2}$ "	4050
	3"	1" to 3"	2 sets each of 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , $1\frac{5}{8}$ , $1\frac{7}{8}$ , and 2 and 1 set each $2\frac{1}{4}$ , $2\frac{1}{2}$ , $2\frac{3}{4}$ and 3.	300	500	9' 1"x7' 0"	7800

499

Triple Head Machines	1"	$\frac{1}{4}$ " to 1"	1 set each of $\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ and 1	400	550	5' $4\frac{1}{2}$ "x4'11 $\frac{1}{2}$ "	3350
	$1\frac{1}{2}$ "	$\frac{1}{2}$ " to $1\frac{1}{2}$ "	1 set each of $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{5}{8}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ and $1\frac{3}{4}$ .	250	360	5' $4\frac{1}{2}$ "x4'11 $\frac{1}{2}$ "	3650
	2"	$\frac{1}{2}$ " to 2"	1 set each of $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , and 2.	500	700	6' $1\frac{1}{2}$ "x6' 1"	5400

## STAYBOLT MACHINES

Sin. Head	$1\frac{1}{2}$ "	$\frac{1}{2}$ " to $1\frac{1}{2}$ "	As desired	225	360	2' 3"x7' 3"	1450
Dou. Head	$1\frac{1}{2}$ "	$\frac{1}{2}$ " to $1\frac{1}{2}$ "	As desired	225	360	3' $6\frac{1}{2}$ "x7' 3"	2650

## SPECIFICATIONS OF STANDARD PIPE AND NIPPLE MACHINES

Type	Size	Range	Chaser Equipment	R. P. M. Countershaft		Floor Space Required	Approx. Net Weight Lbs.
				Carbon Steel	H. S. Steel		
Sin. Head Mach.	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	1 set each 27, 18 and 14 Pitch.	180	400	1' 9"x4' 6"	850
	$1\frac{1}{4}$ "	$\frac{1}{2}$ " to $1\frac{1}{4}$ "	1 set each 27, 18, 14, and $11\frac{1}{2}$ Pitch.	300	425	2' 3"x5' 1"	1400
	2"	$\frac{1}{2}$ " to 2"	1 set each 18, 14 and $11\frac{1}{2}$ Pitch.	225	400	2' 8"x7' 8"	2200
	4"	$2\frac{1}{2}$ " to 4"	1 set 8 Pitch.	300	500	3' 7"x9' 11"	4650
Dou. Head Mach.	$\frac{1}{2}$ "	$\frac{1}{4}$ " to $\frac{1}{2}$ "	2 sets each 27, 18 and 14 Pitch.	180	300	2'10 $\frac{1}{2}$ "x4' 6"	1400
	$1\frac{1}{4}$ "	$\frac{1}{2}$ " to $1\frac{1}{4}$ "	2 sets each 27, 18, 14 and $11\frac{1}{2}$ Pitch.	300	425	3' 6"x5' 1"	2300
	2"	$\frac{1}{2}$ " to 2"	2 sets each 18, 14 and $11\frac{1}{2}$ Pitch.	225	400	4' 0"x6' 1"	3800
	4"	$2\frac{1}{2}$ " to 4"	1 set 8 Pitch.	350	550	8' 1"x6'10 $\frac{1}{2}$ "	7850

## SPECIFICATIONS OF STANDARD PIPE THREADING AND CUTTING MACHINES

2"	$\frac{1}{2}$ " to 2"	1 set each 14 and $11\frac{1}{2}$ Pitch.	225	400	6' 8"x3' 2"	2650
4"	1" to 4"	1 set each $11\frac{1}{2}$ and 8 Pitch.	300	500	9' 10"x4' 4"	6600
6"	1" to 6"	1 set each $11\frac{1}{2}$ and 8 Pitch.	275	450	9' 10"x4' 4"	6600
8"	$2\frac{1}{2}$ " to 8"	1 set each 8 Pitch and 8 Pitch.	225	400	9' 10"x4' 0"	10000

*Dies, Taps, Reamers, Gages, Lathes, Saw Sharpeners*

## GREENFIELD TAP & DIE CORP'N

GREENFIELD, MASSACHUSETTS

**Manufacturers of Screw Cutting Tools and Machinery, Gages and Reamers**

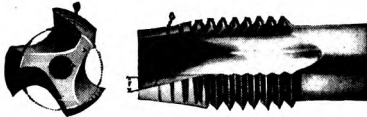
STORES AT

NEW YORK, 28 Warren Street    DETROIT, 74 Congress Street, W.    CHICAGO, 13 South Clinton Street  
Canadian Factory, Wells Brothers Co., of Canada, Ltd., Galt, Ontario



Our line of Tools and Machinery covers a broad field. We are essentially makers of Screw Cutting and Measuring Tools. The line, however, includes other Tools and Machines that are closely allied. A fairly comprehensive list follows. We want to supply you with catalogs and booklets. Please state what you are particularly interested in.

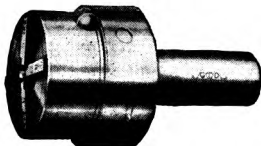
### SCREW CUTTING TOOLS:



500

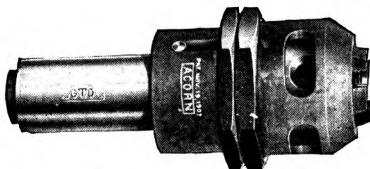
"Gun" Tap

**Taps:** For every purpose from watch-making to bridge-building, including the shear cutting "Gun" Tap.



Wells Self-Opening Die

**Dies:** Wells Self-Opening Die, Acorn Die and Holders and a variety of Adjustable Dies for hand and machine use.



Acorn Die and Holder

**Screw Plates:** More than one hundred different assortments of Taps and Dies to meet every possible requirement.

### GAGES:

**Screw Thread:** Plug and Templet, Limit Snap Gages, Screw Pitch Gages, etc., made for all threads, forms and pitches.

**Cylindrical:** Plug and Templet and Adjustable Limit Snap Gages in all sizes.



Cylindrical Limit Snap Gage

**Special:** We design and manufacture Special Gages of any type and outline complete gaging systems for any product.

### REAMERS:



Solid Reamer

**Spiral Fluted:** Reamers of this type give a shearing cut, and they will not chatter or "hog" in. A complete line of straight fluted reamers of all types.

### PIPE TOOLS:

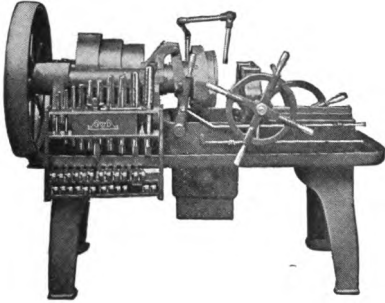
**Stock and Dies:** "Trio" and "Duo" combinations always ready for work, Stocks with O. K. Forged Dies, "Economy" Stocks and Dies and Armstrong Type of Adjustable Dies. Also complete tool sets.

**Wrenches, Cutters and Vises:** A line of pipe tools that has always been popular.



## GREENFIELD TAP & DIE CORP'N

### GTD MACHINE TOOLS:



### GTD THREADING MACHINES:

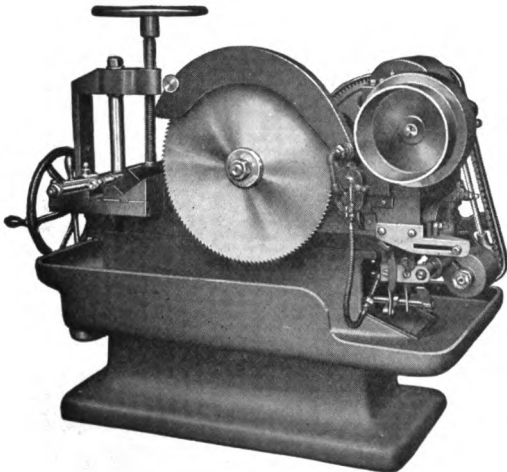
We make a complete line of threading machines from the little, hand bench outfits to the large power machines with automatic opening die heads.

The machines are geared high as well as having an exceptionally rapid adjusting mechanism and because of these features they are equally good for threading both large lots and on job work.

### NUTTER & BARNES CUTTING-OFF MACHINES:

Nutter and Barnes High Power Cutting-Off Machines (capacity from 0 to 12" dia.) meet every modern metal cutting requirement—accuracy, speed, ease of operation and dependability. Developed to top-notch efficiency, they have greater capacity, size of saw considered, than any similar machine on the market.

Extra powerful drive, single lever control for starting and stopping feed and forced lubrication are some of the important features.



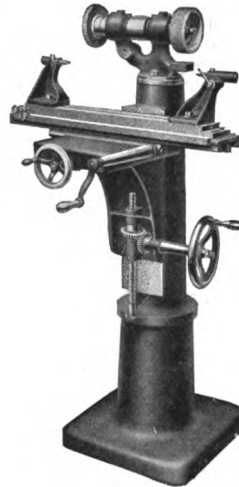
### LATHES:

The "Wells" line of Speed Lathes has been marketed for several years by F. E. Wells & Son Co. Division. These may be had in a number of different models with a variety of equipment. All "Wells" lathes are equipped with taper bronze ring-oiling spindle boxes, which are exceptionally long lived, giving a maximum of service with a minimum of attention. Any model can be furnished with individual motor drive.

### HAND SCREW MACHINES:

"Wells" Hand Screw Machines will handle stock up to 1" diameter. They are provided with wire feed, four- or six-hole turrets and positive lubrication.

The six-hole turret indexes automatically and its under side forms a cam which regulates the stops. It is impossible for this turret to overrun a stop, so that it may be operated by unskilled labor without danger to machine or work.



501

### "Wells" Tool and Cutter Grinders

"Wells" Tool and Cutter Grinders are made in both the Plain and Universal types. The Plain Grinder for either bench or floor use will handle any work which may be ground on the periphery of the wheel. In the Universal Grinder the table is provided with both vertical and radial adjustments so that all classes of work may be ground.

### SAW AND CUTTER SHARPENERS:

For sharpening either plain saws or saws with B & S patent relieved teeth, the Nutter and Barnes saw sharpener is recommended. The automatic sharpeners work with the precision of a well-timed clock.

The teeth are spaced evenly and radially from an index plate which is cut accurately with the same number of teeth as the tool—not from the tool itself. The various models have a capacity of from 2½" to 36" saws and will handle cutters from 2½" diameter up.

# THE BORDEN COMPANY

Established 1901

WARREN, OHIO, U. S. A.

CANADIAN BRANCH: 110 Church Street, TORONTO, CAN.

Manufacturers of "Beaver" Easy Working Die Stocks, "Beaver" Square-End Pipe Cutters and "Improved Ohio" Adjustable Die Stocks (for Export)

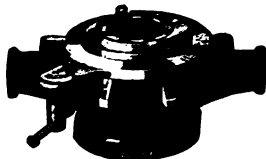
## "BEAVER" EASY-WORKING DIE STOCKS:

In designing and building "BEAVER" TOOLS, durability, convenience and labor-saving have been the first considerations. The selling-price has been considered last—not first. As a result, "BEAVERS" are today used by an ever-increasing number of large discriminating buyers who know that quality does pay. During the war, "BEAVERS" were used almost exclusively by the American Army.



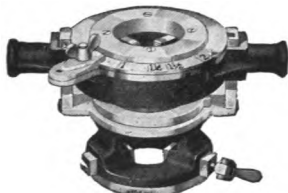
No. 3 Beaver Jr. Ratchet  
 $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and 1 inch

502 This handy little tool is built on the unit plan. Complete, it threads 1,  $\frac{3}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{8}$ ,  $\frac{1}{4}$  and  $\frac{1}{8}$  inch. However, the various units may be purchased separately. The No. 3 "BEAVER JR." possesses several distinct mechanical advantages, but space here does not permit of a full description. Sold by all leading supply houses.



No. 6 Beaverette,  $\frac{1}{4}$  to  $\frac{3}{4}$  inch

For ten years, the No. 6 BEAVERETTE has continued to grow in favor with all classes of pipe users. It threads  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$  without changing dies or bushings. "Move the handle—that's all." It is unmatched for beautiful simplicity and pleasing convenience. Sold by all leading supply houses.

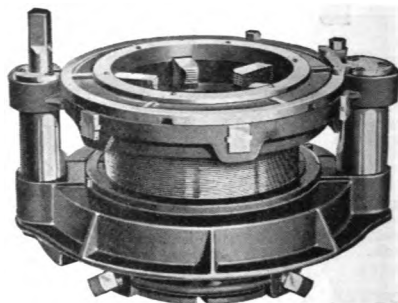


No. 25 Plain, 1 to 2 Inch

"BEAVERS" No. 25 and No. 26 each thread 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$  and 2 inch pipe. The No. 26 is ratchet-driven—an advantage when threading pipe in ditches, close to walls, and so forth. The No. 25 is plain. Made from malleable iron and steel—like all "BEAVER" tools. No dies or bushings to change. Sold by all leading supply houses.

For threading larger sizes of pipe than 2-inch, we manufacture the No. 41 ( $2\frac{1}{2}$  to 4); the No. 61 ( $2\frac{1}{2}$  to 6); the No. 80 ( $4\frac{1}{2}$  to 8) and the No. 90 (9 to 12 inch).

All of these threading machines are light in weight, easily operated by one or two men, and geared to work rapidly. Of course, they are made from high-grade malleable iron and steel—properly machined by skilled mechanics under trained supervision.



No.	Threading Range	List Price
3	$\frac{1}{8}$ to 1	\$24.00
3	$\frac{3}{8}$ to 1	18.00
6	$\frac{1}{4}$ to $\frac{3}{4}$	15.00
25	1 to 2 in.	30.00
26	1 to 2 in. ratchet	35.00
41	$2\frac{1}{2}$ to 4 geared	110.00
61	$2\frac{1}{2}$ to 6 geared	220.00
80	$4\frac{1}{2}$ to 8 geared	300.00
90	9 to 12 geared	500.00

There is a liberal trade discount from these list prices.

## BEAVER SQUARE-END PIPE-CUTTERS:

For cutting off pipe without any outside burr (which ruins and dulls threading dies) or any inside burr (which reduces the capacity of the pipe line). Simple, practical tools—which have been adopted by hundreds of firms who do first-class work.

(Send for complete catalog)



No.	Cut Pipe	List Price
1	$\frac{1}{4}$ to 1 inch	\$18.00
5	$\frac{1}{2}$ to 2 inch	20.00
10	$2\frac{1}{4}$ to 4	90.00
15	$2\frac{1}{2}$ to 6	180.00

Send for complete BEAVER CATALOG No. 111.



# THE CLEVELAND TWIST DRILL CO.

Established 1874

NEW YORK CITY  
30 Reade Street

CLEVELAND, OHIO

CHICAGO  
9 No. Jefferson St.



## "PEERLESS" HIGH SPEED REAMERS (Patented):

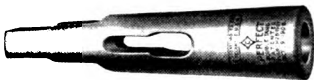
have blades of high-speed steel united with the soft steel body by a patented process which produces a solid, one-piece reamer of unusual toughness, at an appreciable saving in manufacturing cost. This patented method of manufacture links in a single tool the toughness of a carbon reamer with the unique producing capacity typical of only the high speed tool. "Peerless" High Speed Reamers are especially recommended for machine reaming and are furnished in all styles, including expansion.



## "PARADOX" REAMERS (Patented):

combine many of the advantages of both solid and adjustable types. The body is of machinery steel, case-hardened where subject to wear, into which are inserted blades of tool steel. Taper-headed screws wedge these blades firmly against their backing, the blades being counter-sunk at intervals along the shoulder at their base to fit the taper screw-heads.

One of the screws is placed near the end of the blade, giving firm support where most needed, and preventing the tool from "hogging in." This construction gives all the rigidity of a solid reamer.



## "PERFECT DOUBLE-TANG" SOCKETS (Patented):

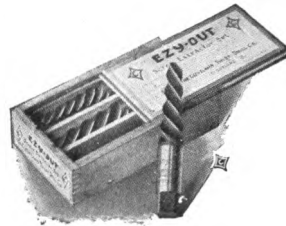
have two driving slots instead of the usual one and afford a simple means of restoring old tools with broken tangs to their original usefulness. They "nest" and will fit any spindle or socket having a regular taper hole.



## "PARAGON" DRILLS:

are not flat bars twisted while hot, but are twist drills *forged* from the original bar of high speed steel in special dies. This method produces correctly shaped flutes and toughens the metal. "Paragon" Drills hold the world's drilling record—57½ inches penetration per minute through cast iron. They may be adapted to Morse standard tapers by means of special sleeves.

## "EZY-OUT" SCREW EXTRACTORS: (Patented):



503

The only tool designed for the express purpose of removing broken set and cap screws, studs and pipe-fittings. Made in 12 sizes. A valuable adjunct to every shop.

TRADE  MARK

Catalog No. 319 Describes All "Cleveland"

DRILLS  
REAMERS  
COUNTERBORES  
SCREW EXTRACTORS  
SOCKETS  
MILLS  
MANDRELS  
ARBORS  
HIGH SPEED TOOLS

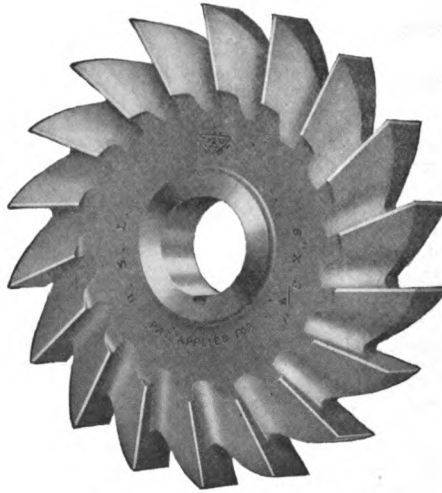
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## GODDARD & GODDARD CO.

DETROIT, MICHIGAN

Manufacturers of Standard and Special Milling Cutters

---



504

"TOOLS THAT GO AND GO"



We have embodied in our  
**"GO AND GO" TYPE OF MILLING CUTTERS**  
features which make them of superlative value in the field of commercial milling today. The style of tooth adopted is the result of careful study and experiment, combining **MAXIMUM STRENGTH** of tooth with **MAXIMUM CHIP CLEARANCE**. The well recognized value of a shearing action versus a scraping action is incorporated in the undercut tooth in contradistinction to the radial cut tooth, thus affording **MAXIMUM PRODUCTION** with **MINIMUM POWER CONSUMPTION**.

Wherever possible also the teeth have been made longer than is current practice,

notably in side milling cutters. More metal has also been left in the web giving added ruggedness to the tool. No recess is made in the hole of the cutters until they are over two inches thick, thus allowing the cutter to be reduced in thickness and still retain its hole diameter.

These tools are all made from the best grade of High Speed Steel obtainable, and very critical attention is paid to the heat treatment, both hardening and tempering.

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**MAXIMUM STRENGTH**

**MAXIMUM CHIP CLEARANCE**

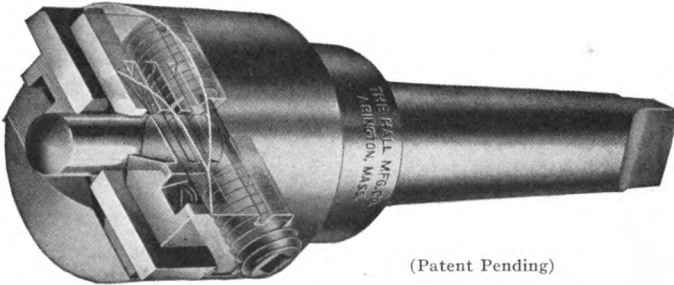
**MAXIMUM PRODUCTION**

**MINIMUM POWER CONSUMPTION**

# THE HALL MANUFACTURING CO.

ABINGTON, MASS., U. S. A.

Manufacturers of Hall Universal Counterbore, and Special Machinery



(Patent Pending)

## THE HALL UNIVERSAL COUNTERBORE, END-MILL, HOLLOW-MILL OR BORING TOOL:

Instead of buying a whole set of solid tools to counterbore various sizes, why not get this one adjustable universal tool that will do what a whole set of solid tools does? Can be used at just as good advantage for end milling, hollow milling, spot facing, counter sinking for machine screw heads, etc.

The illustration shows just how this tool is made. The two interchangeable cutter blades, which are sharpened on four edges, are held solidly in the jaws and adjusted by the right and left hand screw.

These tools are made in various sizes and each size has a wide range of adjustment. For instance—the No. 2 Tool with one set of cutter blades and different sized pilots (the pilot is shown between the blades) will do from  $\frac{3}{8}$  inch to  $2\frac{1}{2}$  inch diameter. You can also use a drill

in place of the pilot and drill and counterbore at one operation. The pilot is held by interlocking jaws, same as in a regular drill chuck. Think of the difference in cost between one set of cutter blades and a set of solid tools.

**Hall Adjustable Universal Tools** can also be used to great advantage on AUTOMATICS.

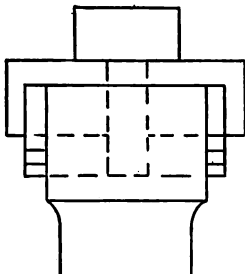
505

Try them in your shop—see what perfect work they do, and how much they save in high speed tool cost. Any shape cutter can be used. Parts are made interchangeable. Material and workmanship guaranteed first class in every respect.

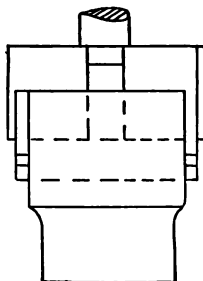
Price includes a set of pilots from  $\frac{1}{4}$  inch to  $\frac{3}{4}$  inch by  $\frac{1}{16}$  and set of high speed cutters.

Size of cutter furnished with No. 2 Tool is  $\frac{3}{16}$  x  $\frac{3}{4}$  x  $\frac{7}{8}$ .

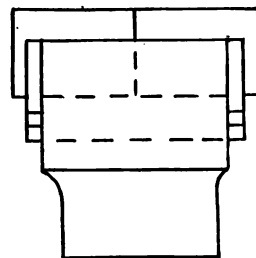
*Showing some of the numerous operations this Universal Tool can be used for.*



Large Hole with Shouldered Pilot



Hollow Milling



Spot Facing

## McCROSKY TOOL CORPORATION

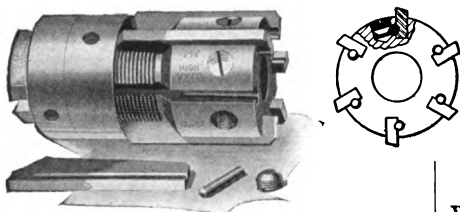
(Formerly the McCrosky Reamer Company)

MEADVILLE, PA., U. S. A.

Manufacturers of Adjustable Reamers, Turret Tool Posts, Wizard Quick-Change Chucks and Collets, Wizard Variable Speed and Reversing Attachment for drill press, Searchlight Universal Lamp Brackets for shop and drafting room, Tap and Die Holders for Turret Lathes, and Other Cost-Cutting Specialties

### SUPER ADJUSTABLE REAMERS:

Give better results than solid reamers, will outwear them ten to one, and then the blades can be quickly renewed at small cost.



All sizes and styles from  $\frac{1}{16}$ " to 12", High Speed or Carbon blades.

A number of exclusive features that put the SUPER almost in a class by itself.

506

1. A better and more rigid method of holding the blades in the reamer body. Practically a solid reamer when assembled.

2. Blades move FORWARD to be adjusted, a very superior feature.

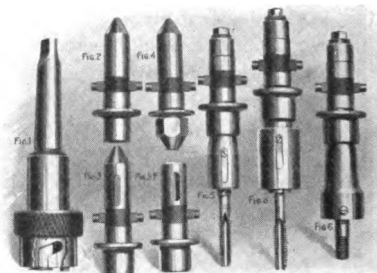
3. Only six sizes of blades required to fit all sizes of shell and chucking reamers from  $\frac{1}{16}$ " to 12".

4. A much larger adjustment, which means much longer wear with one set of blades. For example, a 2" shell reamer adjusts .120 oversize for wear and regrindings.

Hundreds of the best shops have adopted the SUPER as standard equipment. May we figure on your requirements also?

### WIZARD QUICK-CHANGE CHUCKS AND COLLETS:

Will revolutionize any drill press job where it is desired to use more than one tool in succession. Takes all sizes and kinds of tools, such as drills, taps, reamers, special tools, etc., in rapid succession **without stopping the machine**. On many jobs will show 50% saving. Embodies several important features not found in any similar



device. Wizard friction drive collets are unequalled for tapping and stud setting. Wizard No-Needa Tang collets reclaim broken tang drills and forever end all tang troubles.

Try a Wizard outfit on thirty days' approval and watch it make dollars for you. We take the risk.

Our complete catalog of cost-cutting tools sent on request.



Fig. 18



Fig. 20



Fig. 21

# THE NATIONAL TOOL CO.

CLEVELAND, OHIO

Manufacturers of Milling Cutters and Special Tools

CHICAGO OFFICE  
26 South Jefferson St.

STOCK CARRIED  
AT BRANCHES

PHILADELPHIA OFFICE  
40 North Seventh St.

## NATIONAL CLEVELAND MILLING CUTTERS

are widely known for their serviceability and economy. The line is complete, being increased to include new tools whenever the need is recognized. The following list covers the types in general demand and are usually carried in stock. We are fully equipped for the manufacture of

any special types of cutters or similar tools in large quantities. Send drawings or complete specifications for prices.

Angular Cutters

Double

For Spiral Mills

Concave Cutters with Form Teeth

Concave Cutters—Interlocking

Corner Rounding Cutters

Convex Cutters with Formed Teeth

Convex Cutters with Milling Cutter Teeth

Counterbores

Cutters for Making Twist Drills

Cutters for Grooving Straight Lipped Twist Drills

Cutters for Making Four Lipped Twist Drills

Cutters for Fluting Reamers

Cutters for Grooving Taps

Cutters for Grooving Taps and Reamers



End Mills—

Keyway

With Center Cut

Gear Cutters—Involute

Bevel or Mitre

Hobs—

Spur or Spiral Gear Worm Wheel

Hollow Mills—

Adjustable

Shell

Straight Shank

Metric

Solid

Inserted Tooth Cutters—

Face Milling Cutters

Side Milling Cutters

Keyway Cutters—

Woodruff

Metal Slitting Saws

Milling Cutters—

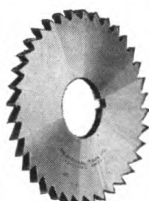
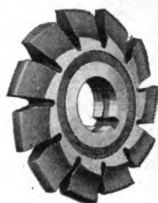
Nicked Tooth

Plain Milling

Side Milling

Interlocking Side

Milling



Sprocket Cutters—

For Block Center Chains

For Roller Chains

Stocking Cutters for

roughing gear teeth

Tee Slot Cutters

Thread Cutters, single and multiple styles

## THE NATIONAL-CLEVELAND INTERCHANGEABLE COUNTERBORE AND SPOT FACER:



Both types of cutters and all parts are interchangeable.

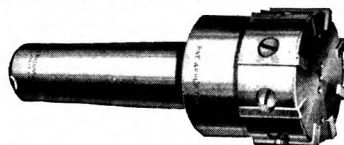
Holders are made of the very best material.

Cutters of High Speed Steel.

Pilots of Tool Steel hardened and ground.

The hole for the Pilot in both the Cutter and Holder is ground to insure a good fit for the Pilot Shank. The Pilot is held in place by a Set Screw. The Cutter is screwed on the Holder and does not depend upon the Pilot for drive.

## THE NATIONAL-CLEVELAND ADJUSTABLE CYLINDER REAMER:



For the Proper Finishing of Engine, or Similar Cylinders without Grinding:

We have designed a special line of reamers for the proper sizing and finishing of engine cylinders and without grinding, the required glass smooth finish can be obtained.

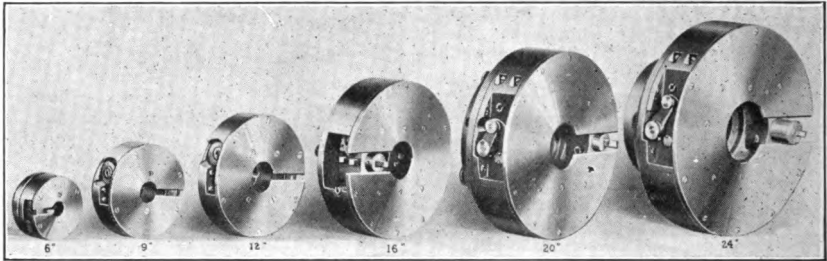
We recommend as a complete outfit two roughers and one floating finisher. The construction of the roughers is the same as the finishers except the floating action is not required. We are prepared to make up these reamers for any size cylinder from 2¼" in diameter up and with shanks or special arrangements for driving to fit various types of drill presses, boring mills, etc.

507

## MUMMERT-DIXON CO.

HANOVER, PA.

Manufacturers of Facing Heads, Portable Radial Grinders and Oilstone Grinders



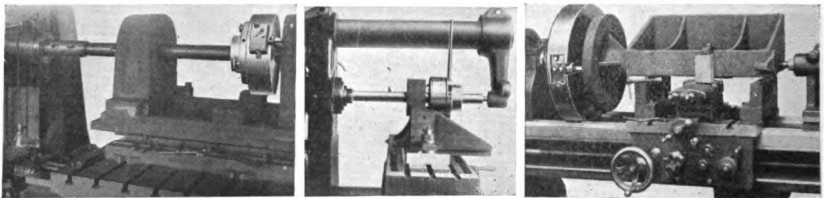
### MUMMERT-DIXON FACING HEADS:

508 The purpose of these facing heads, or turning tools, as sometimes called, is to produce work easily and rapidly, which heretofore, by ordinary methods, was difficult and slow. They can be used in connection with a bar on any machine or apparatus that will hold and drive the bar. The heads can also be used without a bar, on the end of a spindle, such as those of drill presses, milling machines,

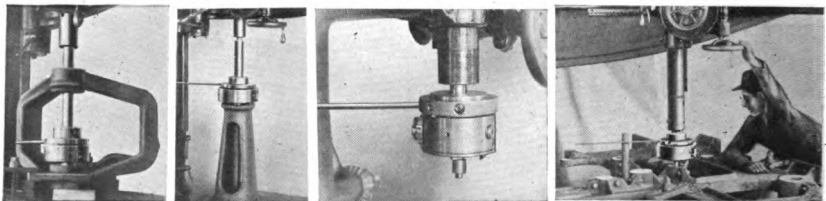
etc., by using an extra tapered shank. They are self-contained and easily overcome the difficulties caused by the old method of the flat spot-facing tools. The bits are removable and easily sharpened.

The smaller heads have one-way tool feed, two feed changes. The larger heads have two-way tool feed (from center out or vice versa) and four changes of feed.

*Full descriptive bulletin mailed on request.*



Facing Head Applied to a Boring Mill, Milling Machine and Lathe

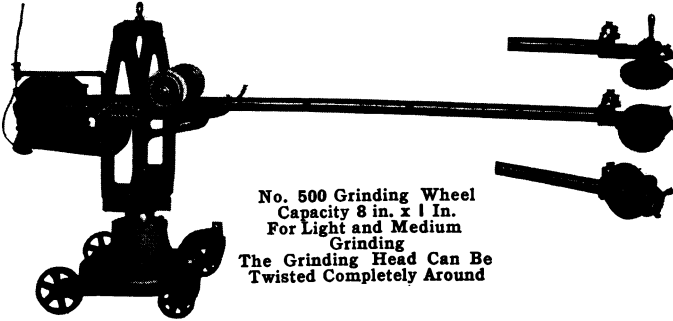


Facing Head Being Used on Drill Presses without Resetting Work

## MUMMERT-DIXON CO.

HANOVER, PA.

Manufacturers of Portable Radial Grinders, Oilstone Grinders and Facing Heads



No. 500 Grinding Wheel  
Capacity 8 in. x 1 in.  
For Light and Medium  
Grinding

The Grinding Head Can Be  
Twisted Completely Around

### MUMMERT-DIXON PORTABLE RADIAL GRINDERS:

Will do 75 per cent. of all grinding that heretofore could only be done with a flexible shaft grinder, and can be done with greater ease and more rapidly.

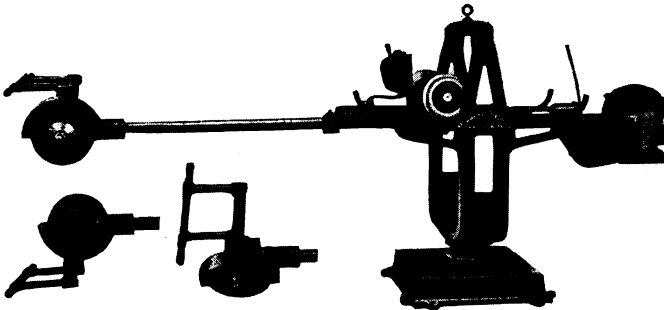
When once in your shop it will be the most used grinder in the place. Why? Because it is light, easy to get to the work and the workman will like it.

in. wide with a mean radius of 6 to 7 feet. Vertical movement of head is down to the floor and upwards as high as a man can reach. Height over all, 4 ft. 6 in. Length over all, 9 ft. Base area, 30 in. x 30 in. Net weight, 700 lbs.

### GENERAL SPECIFICATIONS No. 497:

14 x 2 PORTABLE RADIAL GRINDER. Grinding wheel capacity, 14 in. dia., 2 in. face, 1 1/4 in. hole. Speed

509



No. 497 Grinding Wheel Capacity 14 In. x 2 In.  
For Medium and Heavy Grinding  
The Grinding Head Can Be Twisted Completely Around

### GENERAL SPECIFICATIONS No. 500:

8 x 1 PORTABLE RADIAL GRINDER. Grinding wheel capacity, 8 in. dia., 1 in. face, 3/8 in. hole. Speed of wheel arbor, 2800 R. P. M. Motor, 1 H. P., 1800 R. P. M. A motor suitable for connecting to the lighting circuit is the most convenient when the machine is to be moved from place to place. Length of arm from trolley to head, 7 feet. Travel of trolley, 30 inches. Annular working area is 30

of wheel arbor, 1350 R. P. M. Motor 5 H. P., 1800 R. P. M. Length of arm from trolley to head, 7 feet. Travel of trolley, 36 in. Annular working area, 36 in. wide with a mean radius of 6 to 8 feet. Vertical movement of head is down to the floor and upward to the height of a man. Height over all, 5 feet. Length over all, 10 ft. 4 in. Base area, 33 in. x 33 in. Net weight, with motor, 1300 lbs.

Full descriptive bulletin mailed on request.

## THE CLEVELAND STEEL TOOL CO.

660 EAST 22ND STREET, CLEVELAND, OHIO

Manufacturers of Structural and Plate Workers' Tools

Our system of specifying dimensions of our tools makes it possible and easy to SPECIFY or ORDER—

**CLEVELAND  
STEEL TOOL  
PUNCHES  
DIES  
CHISEL BLANKS  
and RIVET SETS**

EVERY TOOL made by us is guaranteed free from defects in STEEL, TEMPER and workmanship.

Every tool made by us of the justly famous CLEVELAND TOOL STEEL has behind it years of experience, modern equipment and satisfied users all over the country.

510 In our laboratories experts are constantly examining steel, subjecting it to chemical and physical tests together with microscopic inspections.

Samples taken from every order, after hardening, are sent to our Inspection Department and tested in specially designed presses, to show the toughness and hardness of the tool.

In addition to this a complete index system permits us to check the performance of your tools against similar tools. This record extends back over eleven years and gives us an accurate record of all tools turned out by us.

Years ago it was always the rule never to punch steel of greater thickness than the diameter of the punch. When the heavy Bethlehem sections came into use the holes had to be drilled. Since drilling in high carbon steel is an expensive process this form of steel was discarded wherever possible. Now, however, conditions have changed and special punching machines are designed to handle these heavy sections.

Now the United States Government specifications read "Punches must be capable of punching not less than 50 holes through 85 carbon steel whose thickness is one and one-quarter times the diameter of the punch."

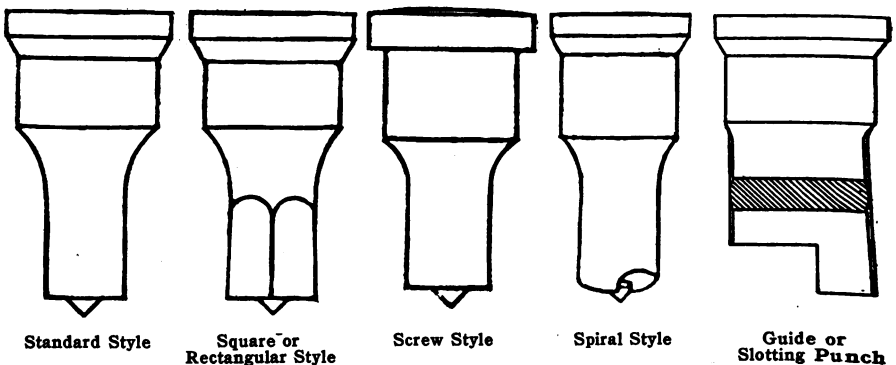
Our company designs and manufactures this class of tools exclusively and we furnish tools which can meet the requirements of the above or similar conditions.

Let us standardize your punches and dies. It means economy, convenience, quick deliveries and satisfaction.

If you are now making punches, dies, etc., in your own shop let us quote you prices and send you samples for trial.

We know we can satisfy you as to quality and price.

*Let us send you our latest catalog and specification sheet.*





# THE L. S. STARRETT COMPANY

ATHOL, MASSACHUSETTS

NEW YORK STORE  
90-92 West Broadway

LONDON WAREHOUSE  
36 and 37 Upper Thames St., E. C.

CHICAGO STORE  
17 No. Jefferson St.

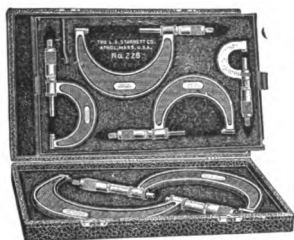
Manufacturers of Fine Mechanical Tools

## STARRETT TOOLS:

Of all the different kinds and sizes of tools which comprise the Starrett line, there is not one but was added to fill a specific need of men who work metal to precision measurements. Utility, accuracy and a uniform quality characterize every Starrett Tool.

Calipers	Leveling Instruments and Levels
Pocket Slide Vernier	Loco'tive Guide Liner
Center Tester, Punches	Micrometers, In., Out.
Clamps	Nail Sets, Pin Vises
Key-Seat	Pliers
Measuring Bar	Plumb Bobs
Parallel, Rule, Steel	Protractors
Countersinks	Bevel, Draftsman's
Dividers	Patent, Univ. Bevel
Draftsman's Tools	End Measuring Rods
Drill Blocks	Rules
Gages	Folding, Shrink, Slide
Bench, Button, Cal.	Scrapers
Center, Circum.	Combination Sets
Depth, Vernier	Sets of Tools
Drill, Tap, Wire	Speed Indicators
Fillet or Radius	Squares
Height, Vernier	Caliper, Carpenters', Center
Hub, Inside Caliper	Combination, Die Makers'
Inspectors	Double, Dftmen's T
Micrometer Caliper	Graduated Hardened
Micrometer Depth	Hardened Edge
Planer and Shaper	Micrometer Caliper
Scratch, Sc. Pitch, Sole	Try, Special Std.
Stair, Surface, Taper	Thin Steel
Telescoping	Straight Edges
Thickness	Steel Tapes
Ground Flat Stock	Test Indicators
Hack Saws and Frames	Trammels
Inclinometers	Transits
Jack Screws	

## MICROMETER CALIPERS:



Made in all sizes from  $\frac{1}{4}$  inch to 12 inches and graduated in both metric and English systems. Furnished with or without standards and with or without lock nut and ratchet stop as desired. All measuring surfaces and bearing parts are hardened. Smaller sizes may be had to measure in ten-thousandths of an inch. Leather cases may be had for any size up to 6 inches, or they may be had in sets with or with-

out velvet-lined morocco leather case. The Starrett line includes standard size micrometer calipers, heavy, screw-thread, hub, paper gage, U. S. Gov't., bench and inside micrometer calipers, micrometer caliper heads and special purpose micrometers and attachments. Catalog of tools sent to any address on request.

## STARRETT HACK SAWS:

Are made of the finest grade of tungsten steel, found after exhaustive experiments to be best adapted to the purpose.

The teeth are sharp, with square cutting points, set evenly and in such a manner that every tooth cuts. The set is just enough to insure a free, smooth, and rapid cut, removing no more stock than necessary. The saws are tempered by our improved process, which leaves them hard and tough, so that they will not "shell off," and are uniform in temper. They are too hard to file. All saws are hardened throughout, except the flexible back saws. Every saw is guaranteed to be of the best quality and adapted to most economically meet the requirements of the class of work for which it was designed.

The Starrett system of selecting saw blades according to the physical and chemical characteristics of the substance to be cut, is founded on the results of experiments conducted by engineers and tests made in our own shops, and its economy of time, material and blades has been proven repeatedly. The Starrett recommendation is not for a multiplicity of blades, but rather for the wise selection of a comparatively small number of saws, each of which will cut a wide range of materials most economically. Thus, according to The Starrett Hack Saw Chart, we find a total of three blades recommended for light Hack Saw Machines; four for the medium and heavy machines; three for the extra heavy power work, and six for hand work, including sheet metal.

511

## STARRETT HACK SAW CHART:

MATERIAL TO BE CUT	No. of Blads for Hand Frame		No. of Blads for Power Machine			
	All Hard	Flexible or Soft Back	Light Machine	Medium Machine	Heavy Machine	Extra Heavy Machine
Light Angles	102	252	115	262		
Channels						
Tee Iron						
Ornamental						
Heavy Angles	108	260	115-B	265		
Channels						
Tee Iron	112					
Light Structural	112-B	260-B	115-B	265	264	266
Heavy Structural	112-B	260-B	114	264-B	264-B	266-B
Steel and Iron Pipe	102	252	115	262	260	
Conduit and						
Brass Pipe						
Solid Stock	105-B	260	114	264-B	264-B	266-B
Cold Rolled						
Machine Steel	112-B	260-B		264-C	264-C	266-C
Tool Steel	108					
Cast Iron	112		114	265	264	266
Brass	108		115	262	260	
	112					
Sheet Metal and Tubing						
Less than 18 gage,	253	252				
Over 18 gage	102	252				

Numbers show the size group in the Starrett General Catalog and on boxes containing the blades

## **E. C. ATKINS & CO., INC.**

Established 1857

HOME OFFICE AND FACTORY

INDIANAPOLIS, IND.

CANADIAN FACTORY, Hamilton, Ont.

MACHINE KNIFE FACTORY, Lancaster, N. Y.

**Makers of Saws and Tools**

Branches carrying complete stocks in all large distributing centers, as follows:

Atlanta  
Chicago  
Memphis

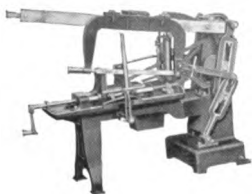
Minneapolis  
New Orleans  
New York City

Portland, Ore.  
San Francisco  
Seattle

Vancouver, B. C.  
Sydney, N. S. W.  
Paris, France

### **ATKINS "KWIK-KUT" METAL CUTTING MACHINES:**

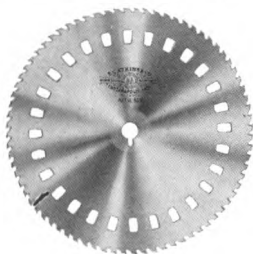
Automatically regulate the stroke, using practically the entire toothed edge of the blade in cutting.



- 512 "Kwik-Kut" machines contain many other distinctive Atkins features that reduce expense and increase production. The machine illustrated is furnished either motor- or belt-driven suitable for cutting stock up to 8".

### **METAL CUTTING SAWS:**

Atkins Circular Metal Cutting Saws are manufactured from steel specially formulated to withstand the rigors of severe service. Advanced methods of manufac-



ture and an exclusive tempering process afford opportunities to get the best possible blades for Higley, Lea-Simplex, Q & C Bryant, and in fact any machine on the market.

### **HACK SAW FRAMES:**

Atkins Hack-Saw Frames show character in their construction. Their perfect balance makes them easy to operate and reduces the possibility of blade twists and breaks.



Atkins Frames are made in several different styles suitable for all kinds of work.

### **ATKINS "A A A" NON-BREAKABLE HAND AND POWER HACK-SAW BLADES:**

Atkins Non-Breakable Hack-Saw Blades are made with the usual hard edge, but with a soft back that prevents breakage.



The edge is tempered so as to insure a cutting capacity superior to "all hard" blades. These blades will cut faster and hold their cutting edge longer than the "all hard" blades, and the liability to break or snap off is entirely eliminated. A necessity in out-of-the-way spots for shop use where inexperienced help is employed.

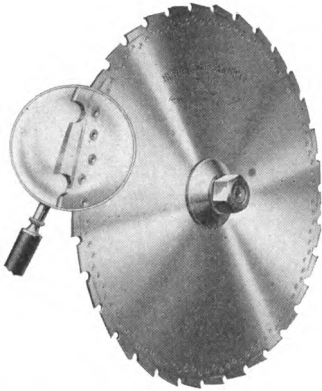
**Makers of all kinds of Saws, Saw Tools and Machine Knives.**

*Descriptive literature sent on request.*

## HUTHER BROS. SAW MFG. CO.

ROCHESTER, N. Y.

Manufacturers of Patent Inserted Tooth Milling Saws, Hack Saws, Circular and Band Saws for Cutting Wood and Metal, Special Cutters, Discs, Knives and Patent Groovers



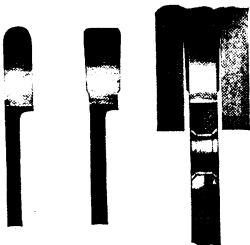
### HUTHER BROS. PATENT INSERTED TOOTH MILLING SAW:

**Thin—Free Cutting—Strong—Flexible**

Two toughly tempered crucible steel plates firmly riveted together form the body of this saw.

The teeth or inserts are of the finest quality high speed steel and are formed so that grinding or sharpening is done on face of tooth only. This not only insures an easy and quick method of sharpening, but a tooth of great strength and long life as well.

The speed of this saw is recommended at from 35 to 55 peripheral feet per minute, feeding against the stock at the



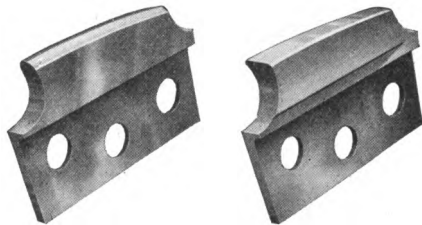
Front View of Teeth

Showing round top and square top teeth in the different heights

rate of  $\frac{1}{2}$ " to 2" and over per minute, according to the nature of the stock and the capacity of the machine.

The teeth have large throat room and ample clearance on both sides and back and are guaranteed to be free cutting and to require the minimum amount of power to operate.

The round top tooth is about  $\frac{1}{8}$ " higher than the square tooth and acts as a roughing tool, taking the chip from the center. The square tooth following removes the chips from either side of the cut. This breaking up of the chips, together with the double clearance of the square tooth, eliminates the possibility of this saw clogging when cutting soft, stringy stock.



Another View of the Two Teeth

Showing the Rivet Holes and Side and Back Clearance

List showing thickness or kerf of saws:

14" diam.  $\frac{3}{8}$ " thick; 18" diam.  $\frac{7}{8}$ " thick; 26" diam.  $\frac{1}{4}$ " thick; 30" diam.  $\frac{3}{8}$ " thick.

**Fine Pitch:** We also manufacture this saw with close pitch tooth,  $\frac{3}{8}$ " to about  $\frac{3}{4}$ " space from point to point. This is not a formed tooth and is not recommended except in cutting small diameter stock, structural steel, rails, etc.

For stock 2" or over, coarse pitch type gives the best results and can be depended upon to give the greater output.

*Write for our Catalog.*

## VICTOR SAW WORKS

SPRINGFIELD, MASS.

Manufacturers of Hack Saw Blades



## VICTOR HACK SAW BLADES:

Are made from Victor Special Private Formula Steel, a semi-high speed alloy of extreme toughness. Every blade is carefully milled, not punched, and is scientifically hardened, not surface burnt. The teeth are set by our Victor patented shear set. Every tooth a perfect cutting tool.

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To get 100% efficiency care should be taken in selecting the right blade, and there is a Victor blade for every purpose. This does not mean a confusing number of blades for we have carefully worked out by experiment and test the best blade for each kind of work.

Regular stock blades always furnished when length only is specified.

The superiority of Victor Hack Saw Blades is due to their being a quality product throughout. The highest quality of materials, made by expensive up-to-date methods of manufacture which leaves nothing undone that will add to the perfection of the finished product; every saw is carefully inspected for the slightest imperfection.

HAND—ALL HARD No. 1							
For Cutting	Regular Stock Blade For General All-Round Work	Soft Steel	Tool Steel	Brass	Thin Tubing	List Price	
		Cast Iron	Hard Steel	Copper	Electric Casing		
			Light Angle Iron	Drill Rod			Iron Pipe
			Sheet Metals	Thin Sheet Metals			Sheet Metals
Size	Teeth per Inch					Per Gross	
8"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	..	8.00
9"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	..	9.00
10"	$\times \frac{1}{2} \times 0.025$	18	14	18	24	..	10.00
12"	$\times \frac{1}{2} \times 0.025$	..	..	..	24	..	12.00
	$\times \frac{3}{4} \times 0.028$	18	14	18	..	..	12.00
14"	$\times \frac{3}{4} \times 0.028$	14	14	18	..	..	12.60
	$\times \frac{3}{4} \times 0.028$	14	14	18	..	..	16.20
HAND—FLEXIBLE No. 2							
8"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	32	8.00
9"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	32	9.00
10"	$\times \frac{1}{2} \times 0.025$	18	14	18	24	32	10.00
12"	$\times \frac{1}{2} \times 0.025$	..	..	..	24	32	12.00
	$\times \frac{3}{4} \times 0.028$	18	14	18	..	..	12.00
14"	$\times \frac{3}{4} \times 0.028$	14	14	18	..	..	16.20

HAND—FLEXIBLE No. 2						
8"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	32 8.00
9"	$\times \frac{1}{2} \times 0.025$	18	18	18	24	32 9.00
10"	$\times \frac{1}{2} \times 0.025$	18	14	18	24	32 10.00
12"	$\times \frac{1}{2} \times 0.025$	..	..	..	24	32 12.00
12"	$\times \frac{3}{4} \times 0.025$	18	14	18	..	.. 12.00
14"	$\times \frac{3}{4} \times 0.028$	14	14	18	..	.. 16.20

## HAND SPECIAL—FOR HARD HIGH CARBON RAILS

Length..... 12 inches  
Price, Special AA, No. 1, 14 and 18 Teeth

..... per gross, \$12.00  
All lengths given for hand blades measure from center to center of holes.

MACHINE—ALL HARD No. 4—FOR LIGHT POWER MACHINE WORK							
For Cutting	Regular Stock Blade	Steel Rails	Light Angle Iron	Heavy High Speed Machine Run with Cutting Solution	List Price		
	For General All-Round Work	Annealed Tool Steel	Iron Pipe	Tool Steel			
		For General Iron	Brass	Machine Steel			
		Soft Steel	Copper	Light Angle Iron			
	Cast Iron	Tool Steel	Heavy Angle Iron	Small Rails			
	Brass	Hard Metal	Large Work	Small Work			
Size		Teeth per Inch				Per Gross	
10"	X 3/4 X .032	14	14	18	.. ..	13.50	
12"	X 3/4 X .032	..	14	..	.. ..	14.40	
12"	X 3/4 X .032	14	14	18	.. ..	16.20	
14"	X 3/4 X .032	14	14	18	.. ..	18.90	
MACHINE—ALL HARD No. 4—FOR HEAVY POWER MACHINE WORK							
For Cutting	Regular Stock Blade	Steel Rails	Light Angle Iron	Heavy High Speed Machine Run with Cutting Solution	List Price		
	For General All-Round Work	Annealed Tool Steel	Iron Pipe	Tool Steel			
		For General Iron	Brass	Machine Steel			
		Soft Steel	Copper	Light Angle Iron			
	Cast Iron	Tool Steel	Heavy Angle Iron	Small Rails			
	Brass	Hard Metal	Large Work	Small Work			
Size		Teeth per Inch				Per Gross	
10"	X 3/4 X .049	10	10	14	.. ..	19.50	
12"	X 3/4 X .049	10	10	14	.. ..	23.40	
12"	X 1 X .049	10	10	14	.. ..	29.40	
14"	X 3/4 X .049	..	..	..	6 8	37.80	
14"	X 1 X .049	10	10	14	8	34.30	
14"	X 1 X .049	..	..	..	8	44.10	
16"	X 1 X .049	10	10	14	.. ..	39.20	
17"	X 1 X .049	10	10	14	.. ..	41.65	
17"	X 1 X .049	..	..	..	6 8	53.55	
17"	X 1 X .065	10	10	14	.. ..	53.55	
17"	X 1 X .065	..	..	..	6 8	85.00	
18"	X 1 X .049	10	10	10	.. ..	44.10	
18"	X 1 X .049	..	..	..	6 8	56.70	
18"	X 1 X .065	10	10	10	.. ..	63.00	
20"	X 1 X .065	10	10	10	.. ..	99.60	
24"	X 1 X .049	..	..	..	6 8	75.60	
24"	X 1 X .065	..	..	..	6 8	120.00	

Lengths of No. 4 power blades measure from center to center of holes, excepting 14 and 17 inch lengths; these measure 13 1/2 and 16 1/2 inches. When length only is specified, we will furnish power blades in all lengths up to and including 14 inches, .032 inch thick. Longer lengths up to 24 inches, .049 inch thick; 24 inches and longer, .065 inch thick.

# MAXF GRINDING WHEEL CORP'N

CHESTER, MASS.

## GRINDING WHEELS:

**"MAXF"**  
TRADE MARK

*By our trade mark "MaxF" (Maximum Efficiency) you shall know a higher efficiency in Grinding Wheels. Better grinding results and bigger production are assured.*



*For behind "MaxF" Wheels is also a service that brings you the right wheel for your work. Enlarged facilities enable us to make prompt deliveries on special orders and we carry a large stock of wheels from which immediate shipment can be made.*

"MaxF" Wheels are manufactured by four different processes, namely, Vitriified, Silicate, Elastic and Vulcanite. The differences in the four "MaxF" processes are chiefly differences in bonds and temperatures of fusion.

**SHAPES OF WHEELS: "MaxF"**  
Wheels are made in the four common shapes, viz.: Straight, Cup, Cylinder

and Dish Shapes, as well as all Special Shapes to fit special grinding machines. In fact, we make wheels for practically all requirements.

### "Maxf Sapphite:"

Our "Maxf Sapphite" Wheels are made from Sapphite, the purest form of aluminum oxide and a product of the electric furnace. Sapphite is produced under the intense heat of about 4,000 degrees F.

"Maxf Sapphite" wheels are designed for all classes of grinding except on material of low tensile strength. They are particularly suitable for grinding steel of high tensile strength and for precision grinding. For internal grinding, cylindrical grinding and any work where time, precision and finish are important they are unexcelled. In the heavier lines of grinding, such as steel castings, malleable iron and general machine shop uses they are equally superior.

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### "Maxf Carbo:"

Our "Maxf Carbo" Wheels are made from Carbo, also a product of the electric furnace, combining the two elements of Carbon and Silicon and forming an abrasive of extreme hardness.

"Maxf Carbo" Wheels are designed for grinding materials of low tensile strength, such as cast iron, brass, bronze, aluminum, granite, hard rubber and wood and for this class of grinding have no superior.

## NORTON COMPANY

WORCESTER, MASS., U. S. A.

NEW YORK STORE  
151 Chambers St.

Bauxite Plant  
BAUXITE, ARK.

CHICAGO STORE  
11 N. Jefferson St.

Electric Furnace Plants  
NIAGARA FALLS, N. Y.—CHIPPAWA, CAN.

Manufacturing Plant  
WORCESTER, MASS.

Manufacturers of Alundum and Crystolon Grinding Wheels, Alundum and Crystolon Grain for Polishing, Alundum Refractories and Laboratory Ware, Glass Cutting Wheels, Sharpening Stones, Scythe Stones, Rubbing Bricks and Stones, Alundum Non-slip Tile, Grinding Wheel Dressers and Grinding Machinery

**Alundum**

TRADE MARK

( $Al_2O_3$ ) is an artificial abrasive the hardness, sharpness and toughness of which are under control during manufacture. This, in combination with its characteristic conchoidal fracture, makes Alundum Grinding Wheels particularly effective upon materials of high tensile strength—notably steel and its alloys.



### GRAIN FOR POLISHING:

Alundum and Crystolon grain are used extensively for polishing many kinds of material. Alundum grain is particularly efficient on steel and other metals of high tensile strength.

### REFRACTORIES:

■ Owing to the high refractory properties possessed by Alundum this substance has been found unequalled for the manufacture of refractory and laboratory ware. Alundum is made into electric furnace cores, tubes, muffles, crucibles, combustion boats, filtering crucibles, cones, extraction thimbles and refractory cements.

### ALUNDUM TILE:

Has a slip-proof and practically wear-proof surface. Adaptable to any place where a safety tread is required.

### SPECIAL RESEARCH SERVICE:

We have well-equipped research laboratories with a competent staff of research engineers and demonstrators who are always ready to give you the benefit of their special knowledge and wide experience in the solving of your special problems.

Any of these Booklets will be sent upon request:

Grinding Wheel Catalog  
Alundum—Crystolon Booklet  
Polishing—What to Use—How to Use It  
Norton Refractories—Alundum and Crystolon  
Saw Sharpening  
The Grinding of High Speed Steel  
Tool Grinding  
Safety as Applied to Grinding Wheels  
Safety in Cutlery Grinding  
Grinding Wheel Dressers  
Grinding Wheels for the Saw Mill  
Alundum and Crystolon in the Glass Industry  
Bushings Grinding Wheels  
Little Known Facts about Grinding  
Grain and Grade as Applied to Grinding  
Wheels

516

**Crystolon**

TRADE MARK

(SiC) is another product of the electric furnace and because of its wonderful purity and remarkable cutting qualities, combined with its greater brittleness, this abrasive has proved highly efficient in grinding cast iron, brass, bronze, aluminum, glass, marble, pearl, and materials of like physical characteristics.

### NORTON GRINDING WHEELS:

Are made by four processes—the vitrified, silicate, elastic and rubber. In the vitrified process, the principal bonding ingredient is clay; in the silicate, sodium silicate is largely used; in the elastic process, the bond is made from a special mixture of shellac and other ingredients; while in the rubber process, a special form of vulcanized rubber is utilized.

Wheels can be furnished in various shapes and sizes to meet grinding requirements. Sizes run from as small as  $\frac{1}{8}$ " diameter to as large as 60" diameter, while the thinnest wheels made are  $\frac{1}{8}$ " thick, and the widest faced 28" thick. All wheels larger in diameter than 5" are subjected to a severe mechanical test before shipment to bring out any inherent weakness.

Wheels are classified by grain and grade, the grain numbers indicating the size of the abrasive cutting particles, and the grade denoting the measure of strength of the bond, or binding material in the wheel which holds the grain in its setting.

# THE STERLING GRINDING WHEEL COMPANY

TIFFIN, OHIO, U. S. A.

CHICAGO HOUSE  
30-32 N. Clinton Street

NEW YORK  
The L. Best Co., 75 Barclay St.  
Selling Agents

Grinding Wheels and Machinery

Sterlith  
Artificial  
Corundum  
  
Sterbon  
Carbolon  
(SiC)



Vitrified  
Silicate  
Elastic

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## A GRINDING WHEEL FOR EVERY PURPOSE:

Sterling Wheels are made by three processes, Vitrified, Silicate, and Elastic. The Vitrified process in the usual bonding in clay. The Silicate process has Sodium Silicate as its base. The Elastic process is a special bonding material made up of Shellac and other ingredients.

Sterling Wheels will be furnished in any standard shapes, made by any of the

several processes used, and from the best kinds of material which are to be had at the present time.

## GRINDING MACHINERY:

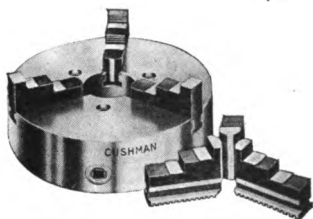
We aim to furnish anything that is needed in the Grinding line and will be glad to have your inquiries and specifications. Prices are right. The goods are right. And Sterling Machinery will please you.

# THE CUSHMAN CHUCK CO.

HARTFORD, CONN, U. S. A.



## UNIVERSAL 3-JAW TYPE:



Style 34 (3-Jaw)

Size	Price	Code
3	\$20.00	Panel
4	22.00	Parasol
5	24.00	Parrot
6	28.00	Pastoral
7½	32.00	Patriot
9	38.00	Pedal
10½	44.00	Peerage
12	52.00	Pensive
15	70.00	Persecute
18	92.00	Perfuse
21	120.00	Perish

This Chuck has one set each of male and female Jaws.

Style 31

Size	Price	Code
3	\$17.00	Palate
4	19.00	Paper
5	21.00	Pardon
6	24.00	Passable
7½	27.00	Patch
9	33.00	Peaceful
10½	38.00	Peel
12	45.00	Penalty
15	60.00	Perfect
18	80.00	Percolate
21	105.00	Perhaps

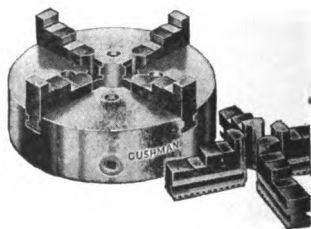
This Chuck has one set of female Jaws only.

Style 32

Size	Price	Code
3	\$17.00	Palm
4	19.00	Parade
5	21.00	Park
6	24.00	Passport
7½	27.00	Pathetic
9	33.00	Peasant
10½	38.00	Peeler
12	45.00	Penitent
15	60.00	Perfume
18	80.00	Perdu
21	105.00	Peril

This Chuck has one set of male Jaws only.

## UNIVERSAL 4-JAW TYPE:



Style 44

Size	Price	Code
3	\$22.00	Poetry
4	24.00	Polarity
5	27.00	Politics
6	31.00	Pomatum
7½	36.00	Populace
9	42.00	Porringer
10½	49.00	Portiere
12	58.00	Porthole
15	76.00	Portrait
18	102.00	Possess
21	135.00	Postal

This Chuck has one set each of male and female Jaws.

Style 41

Size	Price	Code
3	\$19.00	Pocket
4	21.00	Pointed
5	23.00	Polemic
6	27.00	Poltroon
7½	30.00	Pompous
9	36.00	Populate
10½	42.00	Port
12	50.00	Portend
15	65.00	Portico
18	87.00	Poser
21	115.00	Possible

This Chuck has one set of female Jaws only.

Style 42

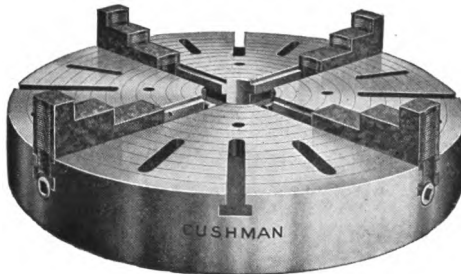
Size	Price	Code
3	\$19.00	Poetess
4	21.00	Poison
5	23.00	Polish
6	27.00	Polygon
7½	30.00	Pontiff
9	36.00	Porosity
10½	42.00	Portal
12	50.00	Porter
15	65.00	Portly
18	87.00	Position
21	115.00	Possum

This Chuck has one set of male Jaws only.



# THE CUSHMAN CHUCK CO.

HARTFORD, CONN, U. S. A.



## INDEPENDENT 4-JAW TYPE

Designed for Holding Pieces of Any Shape, Each  
Jaw Being Independently Operated



### Style 12 Iron Bodies

Size	Wgt.	Price	Code
4½	8	\$20.00	Accede
6	14	22.00	Access
8	30	26.00	Accident
9	35	28.00	Acclaim
10	42	30.00	Accord
12	70	35.00	Accost
14	90	40.00	Accredit
15	105	43.00	Accurate
16	120	46.00	Ache
18	160	54.00	Acid
20	200	62.00	Acorn
22	240	70.00	Across
24	285	80.00	Action
26	310	93.00	Actor
28	355	110.00	Actual
30	440	130.00	Acute
32	525	155.00	Active
34	575	180.00	Actress
36	600	210.00	Acumen

### Style 212 Steel Bodies

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Size	Wgt.	Price	Code
8	30	\$42.00	Escape
10	42	50.00	Eschar
12	70	58.00	Escheat
14	90	67.00	Eschew
16	120	76.00	Escort
18	160	87.00	Eskar
20	200	100.00	Espouse
22	240	114.00	Espy
24	285	130.00	Esquire
26	310	150.00	Essay
28	355	175.00	Essence
30	440	200.00	Estate

These Chucks are designed for Special Service.

Our complete Catalogue showing all regular styles and sizes will be gladly mailed to you upon request.

# D & W FUSE COMPANY

PROVIDENCE, R. I.

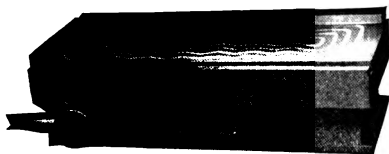
## "D & W" MAGNETIC CHUCKS:

Heatproof—Oilproof—Waterproof

"D & W" Magnetic Chucks are designed to secure the maximum effective holding surface, with exceptionally strong and uniform pull throughout, whereby a wider range of work can be machined than was formerly practicable.

The magnet coils in "D & W" Chucks are wound and insulated by a special process which protects them from heat and moisture.

All chucks are equipped with special enclosed type demagnetizing switches, for 520 automatically releasing the work.



FLAT

Style	Extreme Holding Face	Price Each
F- 7- 8	8 1/4 x 7	\$ 70.00
F- 5-13	13 1/4 x 5 1/2	85.00
F- 7-16	16 1/4 x 7	100.00
F- 8-20	18 3/4 x 9 1/2	135.00
F- 8-24	23 1/4 x 9 1/2	140.00
F-10-31	31 1/2 x 10 1/2	180.00
F-13-21	22 x 13 1/4	170.00
F-13-33	33 1/4 x 13 1/4	240.00
F-10-47	47 1/4 x 10 1/2	Special
F-13-42	42 3/4 x 13 1/4	Special
F-14-48	48 1/2 x 14	Special
F-12-72	72 1/4 x 12 1/2	Special
F-12-88	87 3/4 x 12 1/2	Special

"D & W" standard flat and rotary chucks are designed for use on either 105-125 volt or 210-250 volt D. C. circuits, but not on both ranges. In ordering chucks specify voltage of light-

ing circuit. Alternating current cannot be used.



ROTARY

Style	Diameter	Price Each
R- 3	4 1/8	\$ 50.00
R- 6	6	60.00
R- 8	8	70.00
R-10	10	90.00
R-12	12	125.00
R-14	14	Special
R-16	16	Special
R-18	18	Special
R-20	20	Special
R-24	24	Special
R-30	30	Special
R-38	38	Special

## DIRECT CURRENT GENERATORS:

To customers who have no direct current available for operating magnetic chucks, we are prepared to furnish small (115 VOLT) electric generators of suitable type. These are made for us and guaranteed by a responsible corporation specializing in the manufacture of small motors and generators of the highest quality.

The generators are so small that they can be mounted on a shelf overhead, and can be driven from a very light counter-shaft. They require no attention except occasional oiling, and replacing the brushes once in about two years.

We also manufacture a complete line of specialties, including taper, swivelling chucks, and A. C. and D. C. Demagnetizers. Prices quoted upon application.

Complete catalog upon request.

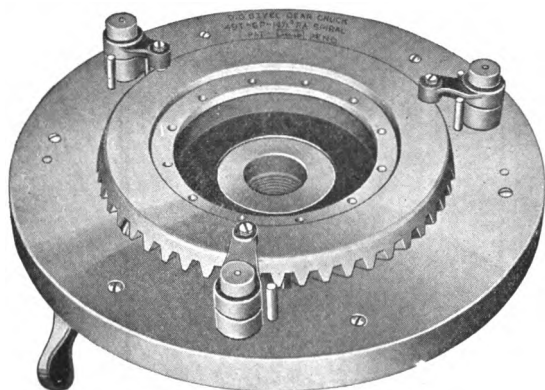
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## GARRISON MACHINE WORKS

DAYTON, OHIO

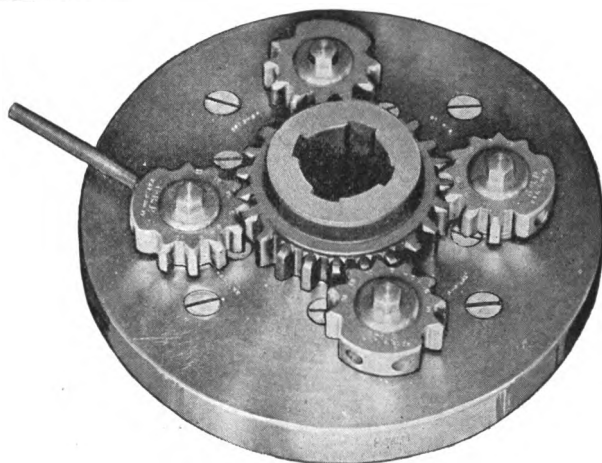
Sole Manufacturers of Johnson and O. G. Gear Chucks

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**O. G. Bevel  
Gear Chuck  
For  
Spur, Helical  
or Skew  
Bevel Gears**

**Johnson  
Gear Chuck  
For  
Spur, Spiral  
Sprocket or  
Internal Gears**



521

### GEAR CHUCKS:

That **WILL ELIMINATE THE LOSS OF GEARS** due to questionable chucking methods, lack of judgment or carelessness on part of operator—they eliminate the **HUMAN ELEMENT**.

Can be applied to any grinder.

They are for manufacturers who demand that holes in gears be ground concentric with the pitch diameter.

Precision tools for production work. Actual chucking time 4 to 6 seconds.

They are being used by prominent machine tool, gear, auto, truck and tractor manufacturers from coast to coast and in foreign countries also.

Always exactly right, no adjusting.

**Chucks for all gears regardless of size, pitch, type or shape.**

*Send us blue prints of all the gears you have to chuck and we will get out specifications as to your requirements.*

# THE HOGGSON & PETTIS MFG. CO.

NEW HAVEN, CONN., U. S. A.

Manufacturers of Lathe Chucks, Special Tools and Machinery, Rubber Mfr's Supplies, Roll Engraving, Etc., Cutting Dies, Steel Stamps

## THE SWEETLAND INDEPENDENT CHUCKS:

### PRICE LIST, DIMENSIONS, ETC.

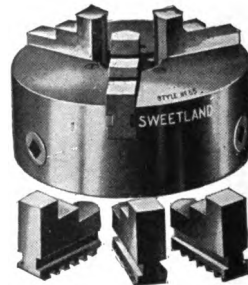
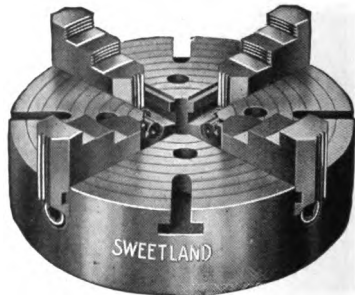
Code	Size In.	Size of Hole Inches	Diameter of Recess for Face Plate, In.	Weight Lbs.	Price
fable	4½	1	4½	7	\$20.00
fabric	6	1½	5½	12	22.00
facade	8	1¾	4¾	28	26.00
facile	9	1¾	5½	32	28.00
facet	10	2¼	5½	42	30.00
faction	12	2½	6½	67	35.00
faculty	14	3	6½	84	40.00
fagot	16	3	7½	117	46.00
faith	18	4	9½	157	54.00
falcon	20	4½	9½	184	62.00
fame	22	5	11	217	70.00
fancy	24	5	11	267	80.00
fashion	26	5	12	315	93.00
fastness	28	5	13	350	110.00
jargon	30	6	15	430	130.00

522



**DIMENSIONS OF ALL GEARED SCROLL CHUCKS**  
Numbers 6, 60, 61, 62, 63, 64, 65 and 66

Size	Net Weight Approx. 1 Set Jaws		Gross Weight Approx. 1 Set Jaws		Net Weight Jaws Per Set		Size of Hole	Diameter of Recess for Face Plate	Will Hold	Diameter of Swing
	3 Jaws	4 Jaws	3 Jaws	4 Jaws	3 Jaws	4 Jaws				
2½	.....	.....	2	.....	.....	.....	¾	1¾	2¾	2¾
3	.....	.....	3¾	4	.....	.....	¾	2H	3¾	3¾
4	7¼	7¼	7¼	7¼	¾	1	1	3	4¾	4¾
5	10½	11	11	11½	1½	1¾	1¾	3H	5½	5½
6	16½	16½	17½	17½	1¾	3	1H	4¾	6¾	6¾
7½	26	28½	29	31¾	3	4	2	4¾	8¾	8¾
9	38	40	41	46¾	3½	5½	2½	5	10½	10
10½	53	53½	61	61½	5½	7½	3	5½	11½	11½
12	69	73½	81	85	8	11½	3½	6H	13	12¾
15	114	117	128	131	8	12	3½	6H	16	15½



COMMON Jaws are Styles No. 61 and 62  
REVERSE Jaws are Styles No. 63 and 64  
REVERSIBLE Jaws are Styles No. 6 and 60

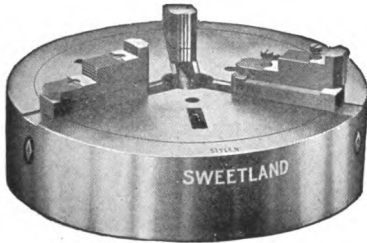
Three Jaw Chucks Style No. 61, 63			Four Jaw Chucks Styles 62, 64		
Code	Size	Price	Code	Size	Price
ingot	2½ in.	\$14.00	inland	3 in.	\$19.00
inhale	3 in.	17.00	inmate	4 in.	21.00
inlet	4 in.	19.00	inmost	5 in.	23.00
install	5 in.	21.00	indorse	6 in.	27.00
issue	6 in.	24.00	induce	7½ in.	30.00
inward	7½ in.	27.00	indulge	9 in.	36.00
inveigh	9 in.	33.00	incline	10½ in.	42.00
insect	10½ in.	38.00	india	12 in.	50.00
insight	12 in.	45.00	indigo	15 in.	65.00
insipid	15 in.	60.00			

TWO SETS OF JAWS ARE STYLES No. 65 and 66

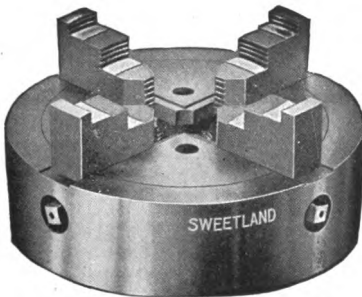
Three Jaw Chucks Style No. 65			Four Jaw Chucks Style No. 66		
Code	Size	Price	Code	Size	Price
ingulf	2½ in.	\$17.00	incase	3 in.	22.00
inject	3 in.	20.00	inboard	4 in.	24.00
insist	4 in.	22.00	incage	5 in.	27.00
instep	5 in.	24.00	incise	6 in.	31.00
iris	6 in.	28.00	inclose	7½ in.	36.00
invest	7½ in.	32.00	incline	9 in.	42.00
inverse	9 in.	38.00	incrust	10½ in.	49.00
intrude	10½ in.	44.00	incur	12 in.	58.00
inform	12 in.	52.00	incurvate	15 in.	76.00
inflict	15 in.	70.00			

# THE HOGGSON & PETTIS MFG. CO.

THE SWEETLAND COMBINATION  
LATHE CHUCKS:

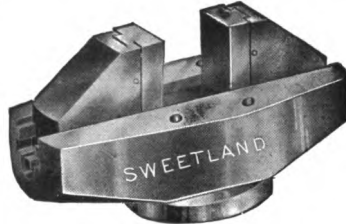


WITH REVERSIBLE JAWS

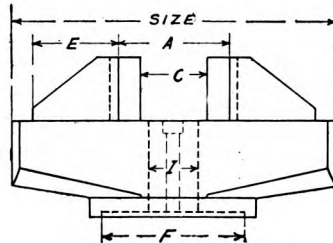


WITH COMMON JAWS

SWEETLAND BOX BODY CHUCK:



Can Be Furnished as Universal or Independent.  
Slip Jaws, Tool or Soft Steel



Front Elevation  
Box Body Chucks

523

## BOX BODY CHUCKS

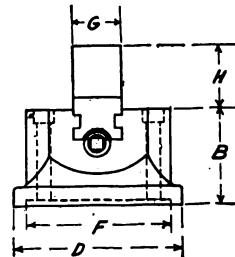
These Chucks Can Be  
Furnished from Stock with  
Three or Four Jaws as De-  
sired

Size	Weight each	A	B	C	D	E	F	G	H	I	Code	Price
In.		In.	In.	In.	In.	In.	In.	In.	In.	In.		
7	20 lbs.	3	3	1 1/2	4 1/2	2	3 1/2	1 3/4	1 3/4	1 3/4	earl	\$28.00
9 1/2	38 lbs.	4	4	2 1/4	5 1/2	2 1/4	4 1/2	2 1/4	2 1/4	2 1/4	earl	33.00
12	50 lbs.	6	6	3 1/4	6	3	5 1/2	2 1/4	2 1/4	2 1/4	earl	40.00
15	75 lbs.	8	8	4 1/2	7 1/4	3 1/2	6 1/2	2 1/4	2 1/4	2 1/4	earl	50.00
18	100 lbs.	10	10	5 1/2	8	4	7 1/2	2 1/4	2 1/4	2 1/4	earl	75.00

## COMBINATION LATHE CHUCKS

Size	Net Wt. Approx.		Gross Wt. Approx.		Diameter of Swing	Will Hold	Size	Diameter of Recess for Face Plate	Price List	
	3 Jaw	4 Jaw	3 Jaw	4 Jaw					Three Jaw	Four Jaw
In.	Lbs.	Lbs.	Lbs.	Lbs.	In.	In.	In.	In.		
6	20	21	23	24	8	6 1/2	1 1/2	3 1/2	\$35.00	\$42.00
9	33	36	41	44	10 1/2	9 1/2	1 1/2	5	45.00	54.00
12	60	65	73	78	13 1/2	12 1/2	1 1/2	5 1/2	58.00	66.00
15	80	84	94	98	16 1/2	15 1/2	1 1/2	5 1/2	70.00	82.00
18	110	116	129	135	19	18 1/2	2	9	87.00	102.00
21	125	147	148	168	22 1/2	21 1/2	2 1/4	9	110.00	130.00
24	145	162	170	187	25 1/2	24 1/2	2 1/4	9	138.00	160.00
30	332	383	379	430	32	30 1/2	4 1/2	12 1/2	200.00	240.00
36	465	529	484	540	38 1/2	36 1/2	4 1/2	12 1/2	264.00	325.00
42	610	640	675	700	44 1/2	42 1/2	4 1/2	24	360.00	450.00

(Continued on next page)



Side Elevation  
Box Body Chucks

(Continued from preceding pages)

# THE HOGGSON & PETTIS MFG. CO.

NEW HAVEN, CONN.

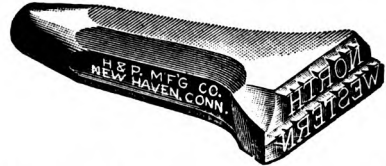
## HAND CUT STEEL LETTERS AND FIGURES:



524 The proper grade of steel is used in the construction of these hand cut steel figures and letters. A size suitable for the letter to go on it is used and is long enough so it can be held without hitting the fingers.

Size, Inches	Price Figures, per set	Price Letters, per set	Price Letters or Figures, each
$\frac{1}{32}$	2.50	7.50	.35
$\frac{1}{24}$	2.00	6.00	.30
$\frac{1}{20}$	1.50	4.50	.20
$\frac{1}{16}$	1.50	4.50	.20
$\frac{1}{12}$	1.50	4.50	.20
$\frac{3}{32}$	1.50	4.50	.20
$\frac{1}{10}$	1.50	4.50	.20
$\frac{1}{8}$	1.50	4.50	.20
$\frac{5}{32}$	1.75	5.25	.25
$\frac{3}{16}$	2.00	6.00	.30
$\frac{1}{4}$	2.20	6.50	.30
$\frac{5}{16}$	2.35	7.00	.35
$\frac{3}{8}$	2.85	8.50	.40
$\frac{1}{2}$	3.35	10.00	.45
$\frac{3}{4}$	4.20	12.50	.60
$\frac{1}{2}$	4.70	14.00	.65
$\frac{5}{8}$	6.80	20.40	.80
$\frac{3}{4}$	9.40	28.20	1.10
$\frac{7}{8}$	12.95	38.75	1.45
1	15.70	47.00	1.75

## HAND CUT STEEL STAMPS:

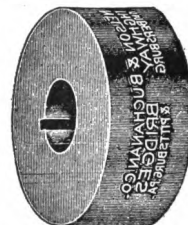


Of all kinds and for all purposes. The work is all strictly hand cut, the letters being correctly shaped and the stamps properly tempered to suit the work they are to do. Price list is for plain letter hand stamps only.

Size, Inches	Price per letter	Size, Inches	Price per letter
$\frac{1}{32}$	.20	$\frac{1}{16}$	.20
$\frac{1}{24}$	.20	$\frac{1}{4}$	.25
$\frac{1}{20}$	.15	$\frac{5}{16}$	.30
$\frac{1}{16}$	.15	$\frac{3}{8}$	.40
$\frac{1}{12}$	.15	$\frac{1}{2}$	.45
$\frac{3}{32}$	.15	$\frac{1}{2}$	.50
$\frac{1}{10}$	.15	$\frac{5}{8}$	.75
$\frac{1}{8}$	.15	$\frac{3}{4}$	1.00
$\frac{5}{32}$	.18	$\frac{7}{8}$	1.25
$\frac{1}{4}$	.20	1	1.50

Stamps with letters over  $\frac{1}{8}$  inch will be charged extra at the rate of 50 cents per pound for steel and forging.

## MARKING ROLLS AND MACHINE STAMPS:



Estimates cheerfully given for machine stamps and marking rolls, completing or for cutting same only. Also for fancy lettering and special designs; stamps for difficult places and shapes.

# THE E. HORTON & SON COMPANY

Established 1851

WINDSOR LOCKS, CONN., U. S. A.

Manufacturers of Chucks

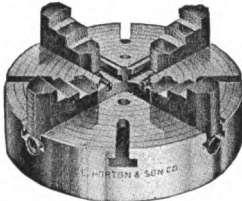
## HORTON IRON BODY INDEPENDENT CHUCK:

Important features of this chuck are:

Large diameter screws with mortise end for operating wrench.

Hardened steel thrust bearings held absolutely rigid in chuck body.

Thrust Bearings placed near the outer end of screw where they are better protected from the chips.



Model 50

### LIST PRICES. MODEL 50

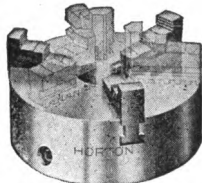
Rated Size, In.	List Price	Rated Size, In.	List Price
4 in.	\$20.00	22 in.	\$70.00
6 in.	22.00	24 in.	80.00
8 in.	26.00	26 in.	93.00
9 in.	28.00	28 in.	110.00
10 in.	30.00	30 in.	130.00
12 in.	35.00	32 in.	155.00
14 in.	40.00	34 in.	180.00
15 in.	43.00	36 in.	210.00
16 in.	46.00	38 in.	245.00
18 in.	54.00	40 in.	280.00
20 in.	62.00	42 in.	320.00

## HORTON GEARED SCROLL UNIVERSAL CHUCK:

The new Horton Geared Scroll Chucks are of the solid body pattern—the body being of double U section giving unusual stiffness. The jaws are locked deeper into chuck on ribs much wider than heretofore used.

The Gearing is much improved, having stronger tooth shapes specially designed for this line of chucks.

Horton Scroll chucks are carefully made to gauges so that at any time extra sets of finished jaws or blank soft jaws can be furnished which will interchange.



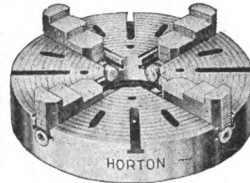
Model 31-C, 3-Jaw

### LIST PRICES—MOD. 34-C AND 44-C

Rated Size, Inches	3-Jaw Mod. 34 C	4-Jaw Mod. 44 C
3 in.	\$ 20.00	
4 in.	22.00	\$ 24.00
5 in.	24.00	27.00
6 in.	28.00	31.00
7½ in.	32.00	36.00
9 in.	38.00	42.00
10½ in.	44.00	49.00
12 in.	52.00	58.00
15 in.	70.00	76.00
18 in.	92.00	102.00
21 in.	120.00	135.00
24 in.	155.00	170.00

## ALL STEEL INDEPENDENT CHUCK:

These salient features, namely, wide jaws, exceptionally large screws with double thrust bearings, and ample bearing surfaces, secure the wearing quality that is most needed for this class of chuck.



Model 60

### LIST PRICES. MODEL 60

Size, In.	List Price	Hole through Chuck	Diam. of Face Plate Recess
8 in.	\$42.00	2½	4¾
10 in.	50.00	2¾	6
12 in.	58.00	3½	7½
14 in.	67.00	3½	7½
15 in.	71.00	4	7½
16 in.	76.00	4	7½
18 in.	87.00	4½	10
20 in.	100.00	4½	10
21 in.	107.00	5	10
22 in.	114.00	5	10
24 in.	130.00	5	12
26 in.	150.00	6½	12
30 in.	200.00	7	15
36 in.	345.00	7½	18

525

## HORTON-MORROW HAND OPERATED DRILL CHUCKS:

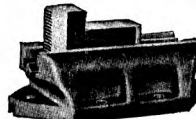
### LIST PRICES FOR STRAIGHT SHANK DRILLS

Chuck No.	Capacity	Price
1	0" to ¼"	\$7.00
2	0" to ⅜"	7.50
3	0" to ½"	9.00
4	¼" to ¾"	18.00
5	½" to 1"	25.00



## HORTON FACE PLATE JAWS

Model 56, Iron Body—Model 58, All Steel. Six sizes each—4 to 14 inches.



Models 56 and 58

### LIST PRICES

Rated Size, Inches	Set of 4 Mod. 56	Set of 4 Mod. 58
4 in.	\$ 40.00	
6 in.	52.00	\$ 72.00
8 in.	64.00	92.00
10 in.	80.00	120.00
12 in.	112.00	160.00
14 in.	144.00	220.00



## MANUFACTURERS EQUIPMENT CO.

WALLER AVE. & FILLMORE ST.  
CHICAGO, ILL.

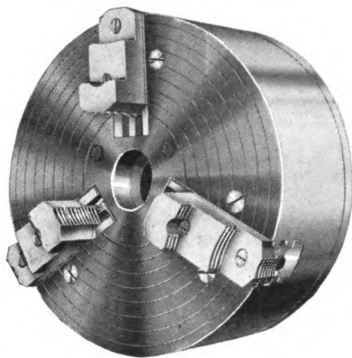
NEW YORK OFFICE

WOOLWORTH BLDG.

NEW YORK CITY

**Manufacturers of Air Operated Chucks, Collapsible Taps and Labor Saving Devices  
for Brass and Iron Goods**

### "M. E. C." THREE JAW AIR OPERATED CHUCK:

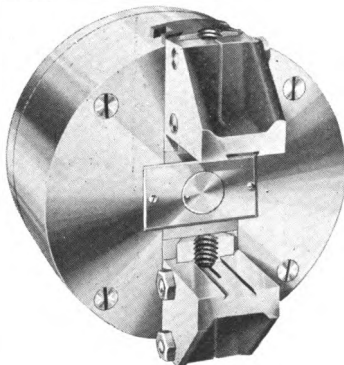


526  
Furnished in two types; Universal Type, with Master Jaws adjustable, and Manufacturing Type, with Master Jaws not adjustable.

BUSHING HOLDER, for pilot bar bushings, also acts as "TIE PLATE" which binds front of chuck together.

"M. E. C." THREE JAW AIR OPERATED CHUCKS are furnished in the following sizes: 6", 8", 10", 12", 15" and 18".

### "M. E. C." TWO JAW AIR OPERATED CHUCK:



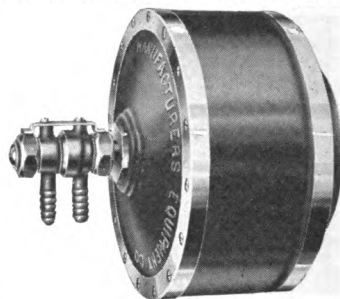
Furnished in one type only with adjustable Master Jaws. Are intended for work usually chucked with screw operated box chucks.

All "M. E. C." Air Operated Chucks

open and close instantly, that is, with very little loss of time.

"M. E. C." TWO JAW AIR OPERATED CHUCKS are furnished in sizes from 6" to 12" inclusive.

### "M. E. C." STYLE "F" AIR CYLINDER:



"M. E. C." STYLE "F" AIR CYLINDER is equipped with piston having "COMPOSITION AIR BRAKE CUP PACKINGS." Cup packings are supported by means of suitable flat and round spring rings. This construction renders piston self-adjustable and practically leak-proof.

The End Fitting, that is, the air supply and exhaust connection, is mounted on piston rod in such manner that air pressure is balanced. This construction entirely eliminates end thrust which causes overheating at bearing points, resulting in rapid wear and loss of air.

All working parts of "M. E. C." Air Cylinders are ground.

"M. E. C." AIR CYLINDERS are furnished from  $3\frac{1}{2}$ " to 16" bore.

We also furnish the "M. E. C." MASTER HINGE COLLET intended for chucking castings and forgings, also for second operation chucking parts made from bar stock.

AIR OPERATED MANDRELS, either plain or compensating, furnished for any class of work.

Our new plant is equipped with modern machinery, fixtures, tools and gauges, which enable us to guarantee first-class workmanship and interchangeability of parts.

Write regarding your problems or requirements.

Literature sent upon request.



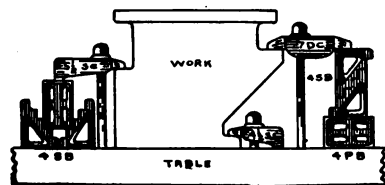
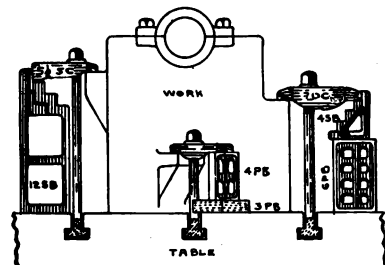
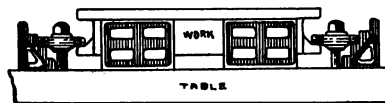
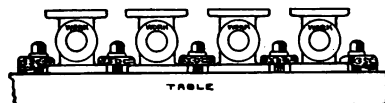
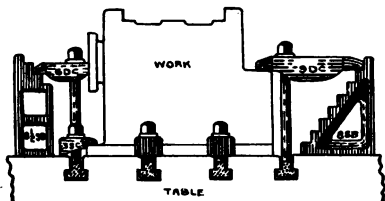
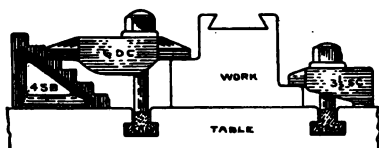
# STANDARD SHOP EQUIPMENT CO.

802-803 REAL ESTATE TRUST BUILDING

PHILADELPHIA, PENNA., U. S. A.

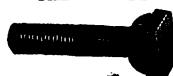
Manufacturers of Set-up Appliances for Machine Tools

## PRACTICABLE APPLICATIONS OF CAD CLAMPS, BOLTS, ETC.



## CAD BOLTS

Will not  
break out  
machine  
table  
slots



Cannot  
turn in  
machine  
table

Pat. Oct. 22, 1918

The CAD bolt is a standard machine  
table bolt ready-for-use

Price per Hundred Bolts without Nuts

*Adapted November 6, 1916*

Length under head	DIAMETER		
	1/4 HEAD 3/4 in. x 3/4	1/2 HEAD 1 1/16 in. x 5/16	3/8 HEAD 1 1/16 in. x 3/8
2 1/2	\$12.00	\$18.00	\$26.00
3	13.00	19.00	28.00
3 1/2	14.00	20.00	30.00
4	15.00	22.00	32.00
4 1/2	16.00	23.00	33.00
5	16.50	24.00	35.00
5 1/2	17.00	25.00	37.00
6	18.00	26.00	38.00
7	20.00	28.00	42.00
8	21.00	30.00	45.00
9	22.50	33.00	48.00
10	24.00	35.00	52.00
12	27.00	40.00	58.00

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## A Standard Tool Room and Machine Shop Clamp

Cat. No.	L'gth	Price
3DC	3"	.20
4DC	4"	.30
6DC	6"	.40
7DC	7"	.50
9DC	9"	.75

## CAD DOUBLE END CLAMP



## The Handiest Clamp Ever Used in a Shop

Cat. No.	L'gth	Price
2SC	2"	.20
3SC	3"	.25
3 1/2 SC	3 1/2"	.30
4 1/2 SC	4 1/2"	.35
5 1/2 SC	5 1/2"	.40

## CAD SINGLE END CLAMP



## A Universal Packing Block for Tool Room, and Machine Shop

Cat. No.	Size	Price
3PB	3x2	.20
4PB	4x2 1/2	.30
6PB	6x3 1/2	.50

## CAD PACKING BLOCK



## Cad Step Block

Cat. No.	Size	Price
4SB	4x3	.50
6SB	6x4	1.00
8SB	8x6	2.00
9SB	9x3	2.00
12SB	12x4	4.00



Write for Catalog A3.

# THE PRATT CHUCK CO.

FRANKFORT, N. Y.

FRANKFORT, N. Y.

FACTORIES

ONEIDA, N. Y.

(Formerly Oneida National Chuck Co.)

NEW YORK  
39 Cortland St.

BRANCH OFFICES:

CHICAGO  
557 W. Monroe St.

**Manufacturers for over 25 years of Lathe and Drill Chucks**

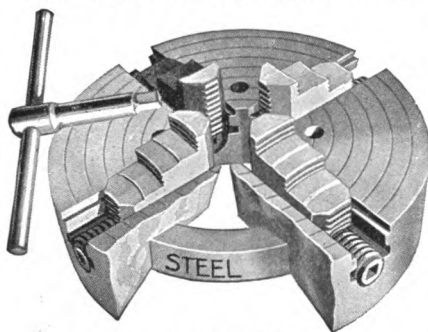
## PRATT-ONEIDA STEEL RE-ENFORCED INDEPENDENT LATHE CHUCK:

Is the latest and greatest improvement in lathe chucks. Ordinary iron body chucks break under great strain; steel body chucks spring out of shape. The Steel Re-enforced Lathe Chuck combines the rigidity of iron and the strength of steel. A massive steel ring is cast into the iron chuck body. This re-enforces the iron and takes up the stresses and strains. Being an integral part of the iron body, it will not spring out of shape. This ring also acts as a thrust bearing for the screws.

The same price as an iron body non-re-enforced chuck; thirty per cent. cheaper than an all-steel chuck.

528

The strength of steel for the price of iron.



See That Steel Ring

### PRICE LIST

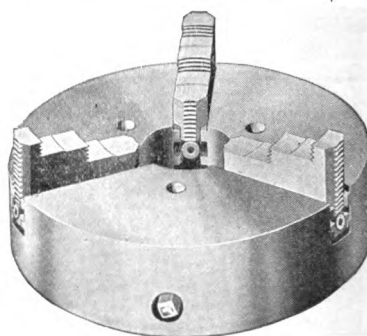
Size	List Price	Code
4	\$20.00	Stone
6	22.00	Stove
8	26.00	Style
9	28.00	Steep
10	30.00	Stop
12	35.00	Stud
14	40.00	Steel
15	43.00	Stung
16	46.00	Steam
18	54.00	Soon
20	62.00	Star
22	70.00	Story
24	80.00	See
26	93.00	Seam
28	110.00	Same
30	130.00	Save
36	210.00	So

## GEARED SCROLL CHUCKS:

### Combination and Universal

#### COMBINATION

Size	3 Jaw	4 Jaw
4	26.00	31.00
6	33.00	39.00
7½	40.00	47.00
9	48.00	55.00
10½	56.00	63.00
12	64.00	75.00
15	85.00	96.00
18	106.00	124.00
21	134.00	152.00
24	170.00	190.00



#### UNIVERSAL

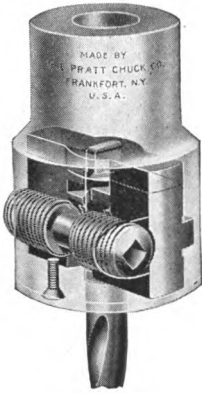
Size	3 Jaw 1 set jaws	3 Jaw 2 sets jaws	4 Jaw 1 set jaws	4 Jaw 2 sets jaws
4	19.00	22.00	21.00	24.00
6	24.00	28.00	27.00	31.00
7½	27.00	32.00	30.00	36.00
9	33.00	38.00	36.00	42.00
10½	38.00	44.00	42.00	49.00
12	45.00	52.00	50.00	58.00
15	60.00	70.00	65.00	76.00
18	80.00	92.00	87.00	102.00
21	105.00	120.00	115.00	135.00
24	140.00	155.00	150.00	170.00

We also manufacture Geared Screw Combination and Universal Lathe Chucks with three or four jaws. Also Two Jaw Round Body Chucks Universal and Independent and Box Body Chucks.

All these styles are conveniently illustrated in a handsome booklet which we will be pleased to send on application.

# THE PRATT CHUCK CO.

The scoring of valuable drills, breaking of chuck jaws and screws, lost motion of the drills and the general lack of efficiency resulting from the use of old style friction chucks, renders them out of place in most modern drilling operations. A chuck employing an immovable slot to receive the drill tang, does not fill the bill, because the slightest inaccuracy in the tang prevents the drill from running true.



**THE PRATT-ONEIDA POSITIVE DRIVE CHUCK** (patented) employs a steel driver—roughly rectangular in shape—fitted into a similarly shaped aperture in the chuck body above the jaws. The drill tang is slipped into the slot in the driver. The driver does all the driving. Its drive is absolutely positive. The driver is allowed a slight lateral movement allowing the jaws to center the drill with absolute accuracy—even though the tang be out of true.

The result—No broken chuck jaws or screws—No scored drills—No lost motion through slippage.

PRICE LIST—POSITIVE DRIVE

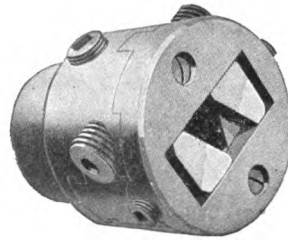
No.	Cap., in.	Price
0	0— $\frac{3}{8}$	\$8.50
1	0— $\frac{1}{2}$	9.00
2	0— $\frac{3}{4}$	10.00
3	0—1	12.00
4	0—1 $\frac{1}{2}$	22.00
5	0—2	26.00

## EMPIRE FRICTION CHUCKS:

PRICE LIST

No.	Cap., in.	Price
6	0— $\frac{1}{4}$	\$6.00
6 $\frac{1}{2}$	0— $\frac{3}{8}$	6.50
7	0— $\frac{1}{2}$	7.00
8	0— $\frac{3}{4}$	8.00
9	0—1	10.00
10	0—1 $\frac{1}{2}$	20.00
11	0—2	25.00

**THE PRATT-ONEIDA TRIPLE GRIP CHUCK** furnishes three distinct grips on a drill or tap and is extremely valuable for work on hollow spindle machines where a positive drive chuck cannot be used. It is not necessary to use all three grips unless the work be of a nature to require them.

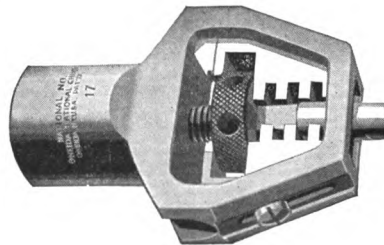


PRICE LIST—TRIPLE GRIP

No.	Drill Capacity	Price
20	0— $\frac{1}{2}$	\$8.00
21	0— $\frac{3}{4}$	9.00
22	0—1	10.00
22 $\frac{1}{2}$	0—1	11.00
23	0—1 $\frac{1}{2}$	18.00
24	0—2	20.00

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**THE PRATT-ONEIDA SKELETON CHUCK** is the lightest chuck, size for size, on the market. It is easily cleaned, casts no shadow and is exceedingly simple in construction. Projecting jaws permit the use of short or broken drills.



PRICE LIST—SKELETON

No.	Holding Drills	Price
1	0— $\frac{1}{4}$	\$6.00
2	0— $\frac{3}{8}$	7.00
3	0— $\frac{1}{2}$	8.00
4	0— $\frac{3}{4}$	9.00
5	0—1	11.00
6	0—1 $\frac{1}{2}$	19.00
7	0—2	21.00

## J. H. WILLIAMS & CO.

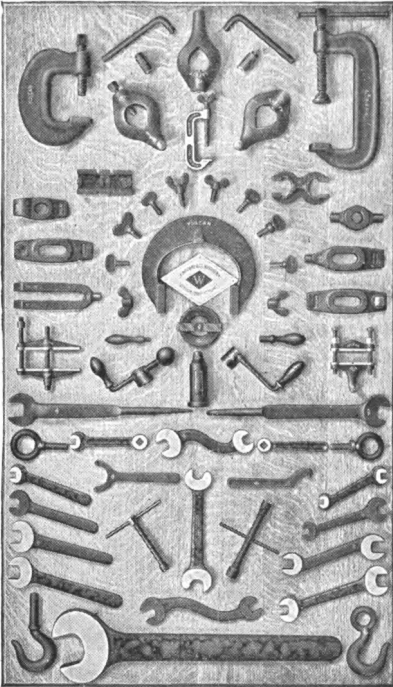
70 RICHARDS ST., BROOKLYN, N. Y.

70 VULCAN ST., BUFFALO, N. Y.

Western Office and Warehouse, 70 So. Clinton St., CHICAGO


**Manufacturers of Drop-Forgings**

### WILLIAMS' SUPERIOR DROP-FORGINGS AND DROP-FORGED TOOLS:



Stock Forgings

#### STANDARD STOCK LINES:

of "Vulcan" and  and "Agrippa" Brands of Tools and Forgings, including

#### Drop-Forged Wrenches:

in about 1000 Sizes in 40 Patterns with openings  $\frac{3}{16}$ " to  $7\frac{1}{8}$ ".

#### Tool Holders:

for the economical use of High Speed Steel in Turning, Planing, Boring, Threading, Knurling, Cutting-off, Side Work, etc.

#### Lathe Dogs:

the "Safety" kind—Capacities  $\frac{3}{8}$  to 6 inches.  
Bent and Straight Tail—One or Two Screws.

#### "C" Clamps:

Four Patterns—for Heavy, Medium, Light Service and Tool Makers.

#### Strap Clamps:

6 patterns, 3 to 4 sizes each, to replace old, clumsy hand-made affairs for clamping work on Planer, Lathe, Drill-Press, etc.

#### Chain Pipe Wrenches and Vises:

"Vulcan" with "proof-tested" Flat Link or Cable Chain.

#### Eye Bolts:

Plain and Shoulder Patterns— $\frac{1}{4}$  to  $2\frac{1}{2}$ " diameter Shanks—Blank or Threaded. Heat-treated and "proof-tested."

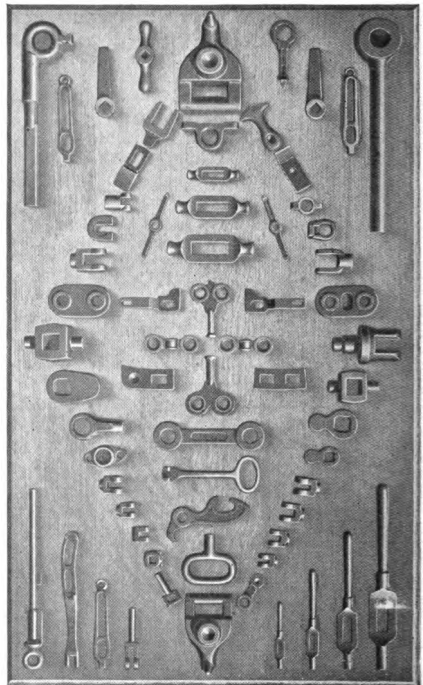
#### Hoist Hooks:

Shank and Eye Patterns, heat-treated and "proof-tested," for  $\frac{1}{2}$  to 25 tons Safe Working Load.

#### SPECIAL FORGINGS:

Small or large, to order for "Quality" work—Airplane and Automobile Crankshafts, Connecting Rods, etc., from straight carbon and alloy steels. Our Forge Equipment includes machines with falling weights running from 300 lbs. Board to 12,000 lbs. Steam Drop-hammers.

Ask for Pocket Catalog.



Special Forgings

# THE CINCINNATI BALL CRANK CO.

CINCINNATI, OHIO

BRANCH OFFICE: 1224 Dime Bank Bldg., DETROIT, MICH.

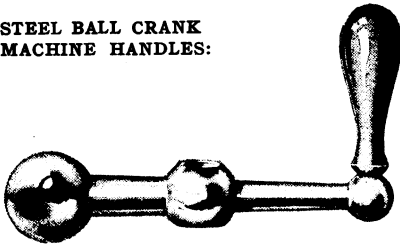
Manufacturers of Steel Products

## HANDLES FROM STEEL:

For power tools and similar purposes

Milled from the bar, drilled, faced and key-wayed to specifications. Highly finished, accurate, complete on receipt and ready to attach.

### STEEL BALL CRANK MACHINE HANDLES:



No.	Length Over All	Center Ball	Large End Ball	Small End Ball
0	3	$\frac{3}{8}$	1	$\frac{5}{8}$
1	$3\frac{1}{2}$	1	$1\frac{1}{8}$	$\frac{3}{4}$
$1\frac{1}{2}$	4	$1\frac{1}{8}$	$1\frac{1}{4}$	$\frac{1}{2}$
2	$4\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$\frac{1}{2}$
3	5	$1\frac{1}{2}$	$1\frac{1}{2}$	1
4	$5\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{2}$	1
5	6	$1\frac{3}{8}$	$1\frac{5}{8}$	1
6	$6\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{3}{4}$	1
7	7	$1\frac{1}{2}$	$1\frac{3}{4}$	1
8	$7\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	1
9	8	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$
10	$8\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$
11	9	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$
12	11	$1\frac{1}{2}$	$1\frac{7}{8}$	$1\frac{1}{4}$
13	13	$1\frac{1}{2}$	2	$1\frac{1}{4}$

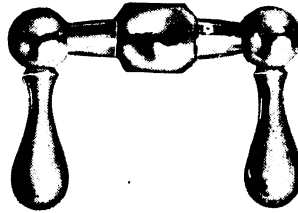
Center ball can be drilled and faced any size desired.

### MACHINE HANDLES:



No.	Length of Shank	Length Over All	Diameter of Shank
000	$\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{4}$
00	$\frac{1}{2}$	2	$\frac{1}{4}$
0	$\frac{1}{2}$	$2\frac{1}{4}$	$\frac{1}{2}$
1	$\frac{3}{8}$	$2\frac{3}{4}$	$\frac{3}{8}$
2	$\frac{3}{8}$	$3\frac{1}{8}$	$\frac{1}{2}$
3	$\frac{3}{8}$	$3\frac{1}{2}$	$\frac{1}{2}$
4	$\frac{3}{8}$	4	$\frac{1}{2}$
5	$\frac{3}{8}$	$4\frac{3}{8}$	$\frac{1}{2}$
6	1	$4\frac{3}{8}$	$\frac{1}{2}$
7	1	$5\frac{1}{8}$	$\frac{1}{2}$
8	$1\frac{1}{4}$	$5\frac{1}{4}$	$\frac{3}{8}$

## COMPOUND REST HANDLES:



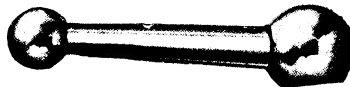
No.	Length Over All	Center Ball	End Balls	
1	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
2	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
3	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
4	3	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
5	3	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
6	3	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
7	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	No handle in ends
8	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in one end
9	$3\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	Handle in both ends
10	4	$1\frac{1}{8}$	$\frac{7}{8}$	No handle in ends
11	4	$1\frac{1}{8}$	$\frac{7}{8}$	Handle in one end
12	4	$1\frac{1}{8}$	$\frac{7}{8}$	Handle in both ends

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Center ball can be drilled and faced any size desired.

## TWO-BALL LEVERS:

Adapted for Tail Stock, Tighteners, Drill Press Clamps, Back Gear Levers, and for all similar purposes



No.	Length Over All	Large End Ball	Small End Ball
2	$4\frac{1}{2}$	$1\frac{3}{8}$	$\frac{1}{2}$
4	$5\frac{1}{2}$	$1\frac{1}{2}$	1
6	$6\frac{1}{2}$	$1\frac{3}{4}$	1
8	$7\frac{1}{2}$	$1\frac{3}{4}$	1
10	$8\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$
11	9	$1\frac{3}{4}$	$1\frac{1}{8}$

Large ball can be drilled and faced any size desired.

Manufactured as a specialty and sold below the manufacturing cost of cast iron or forged handles.

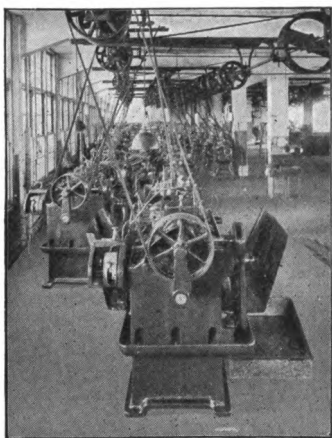
## **BABSON-DOW MANUFACTURING CO.**

Established 1912

60 FULDA ST., BOSTON, MASS.

**Screw Machine Products**

### **"PARTS THAT FIT:"**



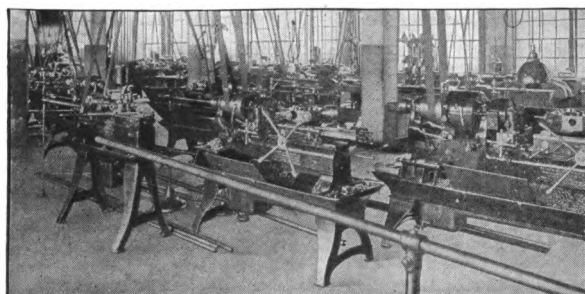
Our Machines are adapted for all varieties of Screw Machine and Turret Lathe Work. Our Automatics produce work from the solid bar in sizes  $\frac{1}{64}$ "-4  $\frac{1}{4}$ ".

### **BABSON-DOW PRODUCTS**

**STAND FOR QUALITY AND ACCURACY**

Goods supplied, case-hardened and ground when desired.

532

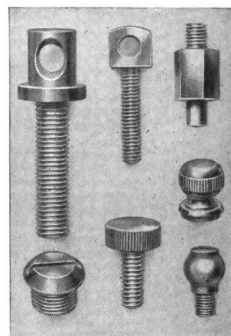


We manufacture parts from

**STEEL  
BRASS  
COPPER  
ALUMINUM  
GERMAN SILVER**

Specializing in High Finish and Accuracy.

Modern equipment insures uniform quality and precision.



Send us samples or blue prints for quotation.

## CINCINNATI SCREW CO.

TWIGHTWEE, OHIO

(Cincinnati Suburb)

**Screw Machine Products**

### ANY PART TURNED FROM BAR:

We are fully equipped to make from specifications a large variety of parts used on automobiles, aeroplanes, steamships, carburetors, electrical apparatus, telephones, firearms, lubricators, bicycles and motorcycles, spark plugs, typewriters, phonographs, machine tools, gas and steam engines, automobile accessories, Ford parts for jobbers, such as cones, rollers, cylinder bolts, plain and castelated nuts; also manufacture a full line of standard set and cap screws, all milled from solid bar.

We are splendidly equipped to make any part from any metal up to four inches in diameter.

Only a special cold drawn steel screw stock, which has proven uniform for threading and forming, is used; this high quality of stock runs true to size and gives better wearing qualities to the screws.

### SET AND CAP SCREWS:

(Milled from Steel Bar)

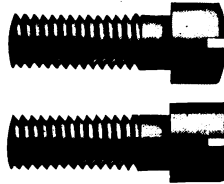
**Set Screws:** Diameters of screw range from  $\frac{1}{4}$  to  $1\frac{1}{4}$  inches and length under Head to Extreme Point from  $\frac{1}{2}$  to 5 inches. Staple sizes usually carried in stock.



**Square Head Cap Screws** are made to order only.



**Hexagon Head Cap Screws:** Staple sizes usually carried in stock.



**Round and Fillister Head Cap Screws:**  
Staple sizes usually carried in stock.



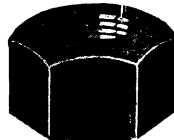
**Flat and Button Head Cap Screws:**  
Made to order only.

**Steel Washers:** Made to specification.

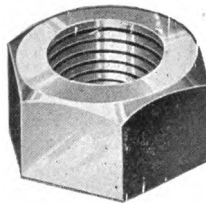
### MILLED NUTS:

533

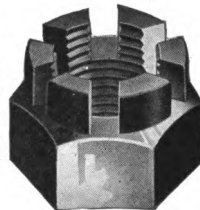
All sizes carried in stock.



Finished Case-Hardened



Semi-finished



Castelated

Estimates submitted on special parts from specification, blue print or sample.

*Illustrated catalog furnished on application.*

## CORBIN SCREW CORPORATION

American Hardware Corporation, Successor  
NEW BRITAIN, CONN.

BRANCHES

NEW YORK

CHICAGO

PHILADELPHIA

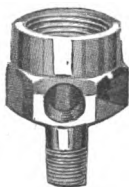
### CORBIN AUTOMATIC SCREW MACHINE PRODUCTS:



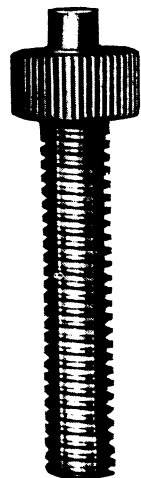
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When we estimate on your individual specifications, you can be certain of the highest quality materials and workmanship. The Corbin reputation stands squarely back of all Corbin Automatic Screw Machine Products.



They are made for greater service, satisfaction. Unusually perfected facilities assure their prompt production.



Immediate quotations on receipt of Specifications, Blueprints, or Samples.



# AMERICAN SCREW COMPANY

PROVIDENCE, RHODE ISLAND

Makers of Wood Screws, Machine Screws, Stove Bolts, and Tire Bolts

## WOOD SCREWS:

Flat, Round, and Oval Head Wood Screws are made in Iron and Brass, from  $\frac{1}{4}$ " to 6" in length, and from No. 0 to No. 30 (screw gauge)



Flat Head



Round Head



Oval Head

in diameter. The length measurement includes the whole of the head of flat heads, the counter-sink of oval heads, and about half the head of round heads.

## DRIVE SCREWS:

Drive Screws are used by being driven in with a hammer, like nails, but they have greater holding power and can be withdrawn with an



ordinary screw driver. They are made in Iron, flat head only, from  $\frac{1}{2}$ " to  $3\frac{1}{2}$ " in length, and from No. 4 to No. 20 (screw gauge) in diameter.

## SCREW GAUGE IN DECIMALS OF AN INCH

No. In.	No. In.	No. In.	No. In.	No. In.
0 .058	5 .124	10 .189	15 .255	22 .347
1 .071	6 .137	11 .203	16 .268	24 .374
2 .084	7 .150	12 .216	17 .282	26 .400
3 .097	8 .163	13 .229	18 .295	28 .426
4 .111	9 .176	14 .242	20 .321	30 .453

## TIRE BOLTS:



Plain



Fluted

Tire Bolts are made in Iron from  $\frac{1}{4}$ " to  $\frac{3}{8}$ " in diameter, from 1" to 6" in length, and in two brands. "Bay State" bolts are furnished either plain or fluted, and following trade custom are somewhat smaller in diameter than "Eagle Phila-

delphia" bolts of the same nominal diameter. "Eagle Philadelphia" bolts are furnished plain only. The length measurement includes the head.

## MACHINE SCREWS:

Flat, Round, and Fillister Head Machine Screws are made in Iron and Brass, from  $\frac{1}{16}$ " to 4" in length, and from No. 2 to No. 34 (screw gauge) in diameter. The length measurement



Flat Head



Round Head



Fillister Head

includes the whole of the head of flat heads, and excludes the whole of the head of round and fillister heads.

## STOVE BOLTS:

Though known in the trade as Stove Bolts, these bolts, made from bright iron wire, are in general use for all purposes requiring small plain bolts.

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Flat Head



Round Head

Flat and Round Head are made from  $\frac{1}{8}$ " to  $\frac{1}{2}$ " in diameter, and from  $\frac{1}{2}$ " to  $6\frac{1}{2}$ " in length. The length measurement includes the head of flat heads, and excludes the head of round heads.

## STOVE RODS:

Stove Rods are the same as Stove Bolts in every respect excepting length. They are made in Iron of  $\frac{1}{4}$ " and  $\frac{1}{2}$ " diameter, and from 7" to 40" in length. The length measurement includes the head of flat heads, and excludes the head of round heads.



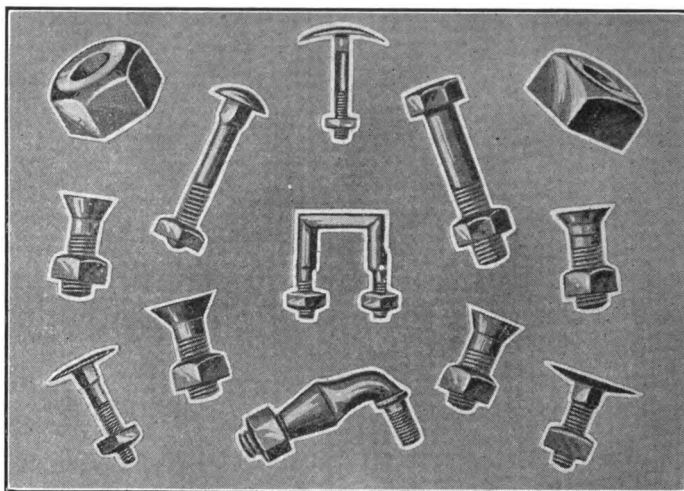
This company is the longest established (1838) and the largest maker of the articles here shown, and it carries a large stock, ready for immediate delivery, comprising, in addition to the varieties commonly in demand, a large assortment of varieties less frequently called for and often difficult to obtain elsewhere.

Price Lists, showing the exact range of sizes as well as the prices, will be sent on application.

## THE COLUMBUS BOLT WORKS CO.

COLUMBUS, OHIO

Bolts, Nuts, Rivets and Special Forgings



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*Over 40 years' experience in manufacturing these lines insures best quality.*

### Bind Quality with Quality

Our Bolts, Nuts, Carriage Hardware and Automobile Forgings are upholding the reputation of many products.

Write for Catalog E.

Send blueprints with quantity wanted for prices on Special Forgings.

Blank Bolts  
Common Carriage Bolts  
Eagle Carriage Bolts  
Fancy Head Carriage Bolts  
Cultivator Bolts  
Drift Bolts  
Eye Bolts  
Fender Bolts  
Hook Bolts  
Machine Bolts  
Nuttet Staples  
Plow Bolts

Spring Bolts  
Step Bolts  
Stove Bolts  
Tap Bolts  
Tire Bolts  
Cap Screws  
Coach Screws  
Lag Screws  
Set Screws  
Rivets— $\frac{7}{16}$ "  $\times$  6" and smaller  
all standard heads

Nuts: Hexagon, Square and special—  
Semi Finished, Finished, Hot pressed  
Forged, Cold punched, chamfered,  
trimmed and reamed—Thumb.

Washers: Round, square and special  
shape; Wrought Iron.

Yoke Ends  
Rod Ends for Yokes  
Yoke and Rod End Assemblies  
Turn-Buckles  
Cold drawn Rods  
Carriage Forgings  
Axle Clips  
King Bolts  
Shaft Couplings  
Drop Forgings to blueprint.

# THE FALLS RIVET COMPANY

KENT, OHIO

Established 1881

## DISTRICT OFFICES

Ford Bldg.  
DETROIT, MICH.

Otis Bldg.  
CHICAGO, ILL.

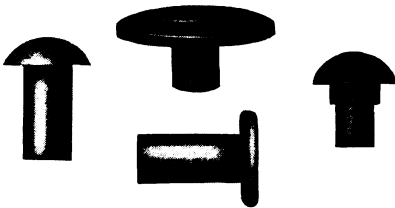
Harrison Bldg.  
PHILADELPHIA, PA.

1138 E. 125 St.  
CLEVELAND, O.

**Manufacturer of all Types and Varieties of Rivets, Bolts, Nuts, Etc.**

The Falls Rivet Company offers service in your fabrication problems through its splendid facilities, skilled workmen and long experience in specializing in the production of rivets, bolts and nuts.

We list, under general headings, our products. In each class we make many types and sizes.



Special Rivets

### RIVETS:

Small  
Large  
Belt  
Boiler

Tinners'  
Coopers'  
Brake Band  
Ship

Special

### BURRS:

Up to  $\frac{3}{4}$ " O. D.

### BOLTS:

Automobile  
Blank  
Carriage  
Coach, G. P.  
Elevator  
Ends  
Fancy Heads  
Fin Heads  
Hanger  
Lag

Loop  
Machine  
Plow  
Sink  
Specials  
Step  
Stove  
Stud  
Tire  
Threaded Wire  
Wheel

### SCREWS:

Steel Machine

Brass Machine

### NUTS:

Cold Punched, champered and trimmed with reamed holes

Cold Punched Plain	Fancy Stove
Hot Pressed	Steel Wing
Semi-Finished	Carriage
Finished — case-hardened	Machine
	Stove



### FINISHING, COATING AND TREATING:

Our Metallic Tinning cannot be excelled for carefulness of application and purity of material and process. We are also equipped to tin-plate, copper-plate and brass-plate.

We are licensed to apply the "Parker Rust Proofing" for those who desire this smooth, lustrous, black finish.



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Electro-Galvanizing can be furnished and the process as applied by us assures the maximum in appearance and resistance to oxidizing.

Our heat-treating and case-hardening departments are operated under the supervision of experts which assures you receiving the good work conforming to your specifications.



Our new catalog No. 19 will be of great value and interest to users of rivets, bolts and nuts and will be gladly sent upon request.

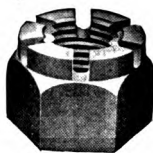
## THE MILTON MANUFACTURING CO.

MILTON, PENNA.

Manufacturers of Cold Punched and Hot Pressed Nuts, Wrought Washers, Refined Bar Iron

### "MILTON" NUTS:

Cold Punched Chamfered Square or Hexagon—Plain Square or Hexagon—Hot Pressed Square or Hexagon (Blank with drilled holes or tapped to Pratt & Whitney Standard)—Semi-finished—Finished, Finished Case Hardened, Slotted and Castle.

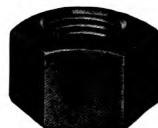


538

From the purchase of the raw materials until the finished product is ready for shipment, the manufacture of "Milton" Nuts is under the constant supervision of men who know, theoretically as well as practically, thus assuring the purchaser of receiving an absolutely uniform Nut, rendering a superlative degree of Efficiency at all times.



Many builders of the most intricate machinery are specifying "Milton" Nuts exclusively, owing to their accuracy, which admits of rigid construction and prevents vibration, at the same time adding mechanical refinement to their machines.



We have faith that, knowing our materials and their uses by technical and practical knowledge, we can meet in our line the highest scientific requirements.

# REED & PRINCE MFG. CO.

WORCESTER, MASS.

Manufacturers of Screws, Rivets, Bolts and Nuts for Every Purpose



## WOOD SCREWS

## MACHINE SCREWS

CAP  
SCREWS

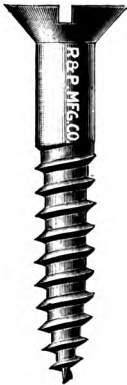
SINK  
BOLTS

RIVETS

SET  
SCREWS

STOVE  
BOLTS

BURRS



## HANGER BOLTS

NUTS

RODS



We are equipped to manufacture special products in connection with our regular line and solicit your specifications.

Let us figure with you on your specials screws, bolts, rods, nuts, rivets, burrs, pins, studs, threaded wires, small stampings.

When special finishes are desired our modern plating department can handle your requirements to your satisfaction.

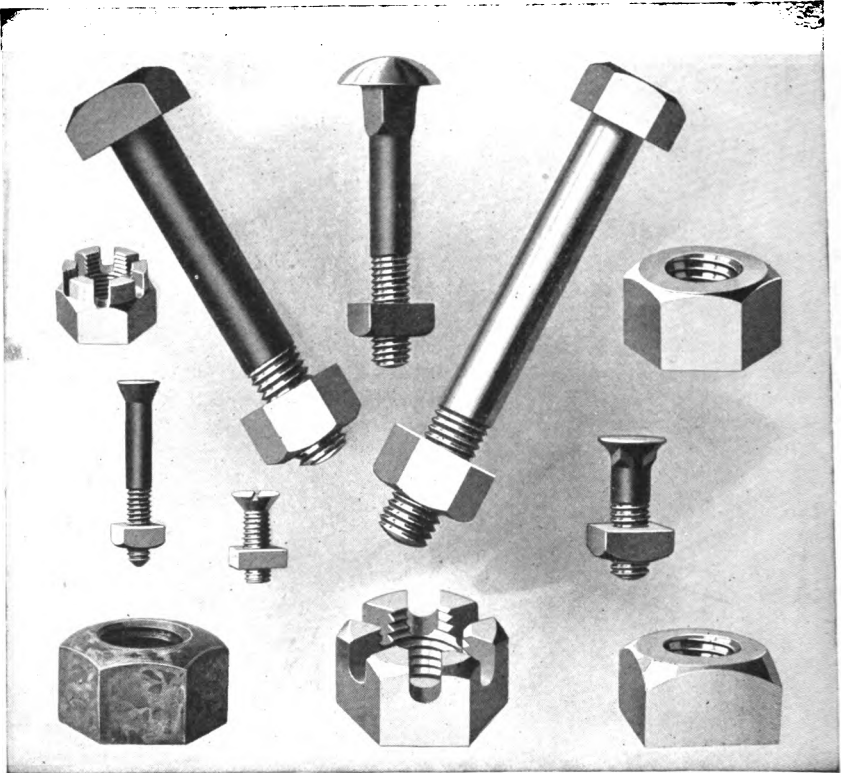
539

We specialize on furnishing nickel, brass, copper, bronze, silver, and oxidized finishes. Can furnish material tinned and galvanized by hot process or electroplated.

## **RUSSELL, BURDSALL AND WARD BOLT AND NUT COMPANY**

PORT CHESTER, N. Y., PEMBERWICK, CONN., ROCK FALLS, ILL.

**Makers of EMPIRE Bolts, Nuts and Rivets**



540

### **THE OLDEST BOLT & NUT HOUSE IN AMERICA:**

This company was the first to engage in the manufacture of bolts and nuts in the United States, and its pioneering experience has resulted in the creation of many labor-saving and quality-improving methods of bolt and nut production.

Russell, Burdsall & Ward were the first to make cold punched steel nuts. They produced the first machine for making cold headed bolts. Among the more interesting of the company's mechanical equipment are machines for cold punching, chamfering, trimming and burnishing steel nuts in one operation. This

equipment is possessed by no other bolt and nut manufacturer in the world.

Throughout every stage of production, Empire Bolts and Nuts are individually inspected—and any bolt or nut that reveals the slightest flaw is immediately discarded. This work of inspection is supervised by an expert tool maker—a man whose eyes and hands are trained to detect the smallest defect.

The company's manufacturing resources are practically unlimited, and any order for any size or style of bolts or nuts, in any quantity, will be delivered on schedule. Requests for estimates will have prompt attention.

# THE CHAMPION RIVET COMPANY

Established 1895  
CLEVELAND, OHIO

WESTERN PLANT, EAST CHICAGO, IND.

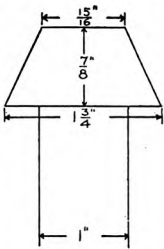
Manufacturers of Boiler, Ship, Structural and Tank Rivets

## VICTOR STEEL RIVETS:

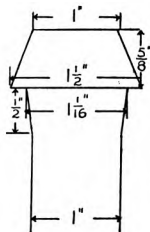
Rivets, though seemingly unimportant, are the most important units entering into the construction of any steel structure.

Upon their quality and the method of driving them, life and property depend.

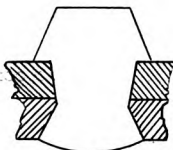
Mechanical Engineers and Marine Architects specify them freely.



CONE HEAD  
STRAIGHT NECK

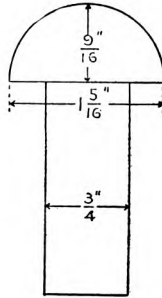


PAN HEAD  
SWELL NECK



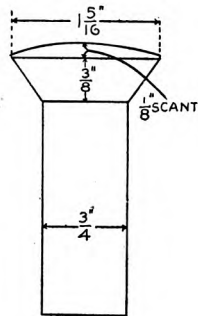
PAN HEAD  
SWELL NECK  
WHEN DRIVEN

The few specimens illustrating this page are not descriptive of our whole line. We manufacture all styles.



BUTTON HEAD

We manufacture all sizes of rivets—from  $\frac{1}{4}$  of an inch in diameter up.



OVAL  
COUNTERSUNK

541

Our rivets conform to Standard specifications such as:

- A. S. M. E. Code.
- American Society for Testing Materials.
- American Bureau of Shipping.
- U. S. Navy Specifications.
- Lloyd's Register of Shipping.

Full data and record of tests furnished on application.

We publish one of the most interesting booklets on this subject. It is entitled SCIENTIFIC FACTS, and is yours for the asking. You will find it contains more information on this seemingly simple subject than has ever been written.

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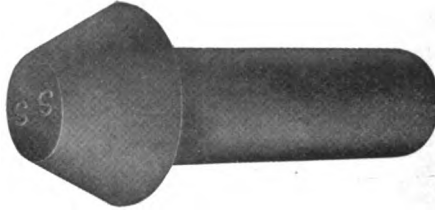
## S. SEVERANCE MANUFACTURING CO.

GLASSPORT, PA. (PITTSBURGH SUBURB)

Established 1828

Manufacturers of Spikes and Rivets

---



This Company makes a specialty of a superior grade of **Soft Open Hearth Steel Boiler Rivets** and is the oldest manufacturer of steel Boiler Rivets in the United States.

542 The plant is most advantageously located in the heart of the Pittsburgh district where superior fuel and highly skilled workmen produce the best quality of soft open hearth steel and the best workmanship in steel products. We have the great advantage of natural gas for fuel, thus eliminating the danger of harmful elements being absorbed in heating our steel. A great deal of harm is sometimes done to first class steel by bringing it in contact with improper fuel and letting it absorb impurities from the fuel as well as burning the steel. Our product is free from these defects.

The most highly skilled workmen in the manufacture of rivets in this district are at our disposal and our organization is largely composed of men who have been with us constantly for years and

whose knowledge and skill in this line of manufacture is of the greatest.

An inferior boiler rivet is a source of great trouble in the manufacture of boilers or any line of manufacture where tight riveting is required and we guarantee our rivets to give better satisfaction than most other brands.

We also manufacture rivets for **ships, bridges, buildings, tanks** or any other purpose where large rivets are used and the same amount of care is given to their manufacture.

Ship rivets are usually made to either Lloyd's or American Bureau of Shipping requirements and a great deal of our product goes to the shipyards. The large structural shops are also large consumers of our rivets.

We can manufacture rivets to any of the standard specifications and make reasonably prompt shipments at all times.



## DIAMOND EXPANSION BOLT CO.

90 WEST ST., COR. CEDAR, NEW YORK

FACTORY: GARWOOD, N. J.

Manufacturers of "Diamond Specialties:" Expansion Bolts and Anchors, Drills, Cable and Pipe Clamps, Conduit Rods, etc.

### DIAMOND EXPANSION BOLTS:



"Diamond N" Expansion Shields—Patented



"Diamond N" Screw Anchors—Patented

"DIAMOND N" TWO PART SHIELDS AND SCREW ANCHORS are used with a standard lag screw and wood screw threads.

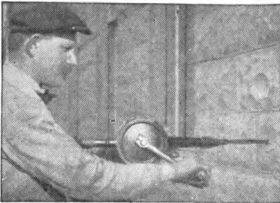
For attaching light and heavy equipment to brick, stone or concrete walls.

### DIAMOND "RAPID FIRE" DRILL:

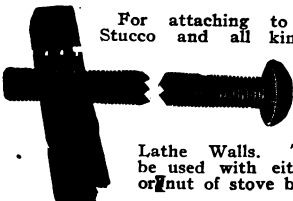


"Rapid Fire" Drill

Reduces cost of drilling hole in brick, stone and concrete. Strikes eight sharp blows with each turn of the crank. Points are interchangeable for all sizes of holes.



### DIAMOND REVERSIBLE TOGGLE BOLTS:

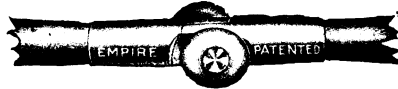


For attaching to hollow tile Stucco and all kinds of metal

Lathe Walls. Toggles may be used with either the head or nut of stove bolt exposed.

### EMPIRE CONDUIT RODS:

Patented No. 911,854, Feb. 9, 1909.



With or without Wheels

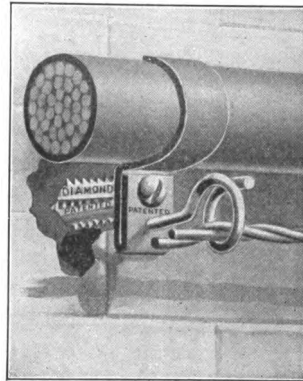
Made of best quality Hickory with quick-acting Automatic Couplings.

### "LONG-SAUT" CABLE AND PIPE CLAMPS:

Used for attaching lead cable and parallel runs of bridle wire in *interior block distribution*.

This form of telephone construction is now being employed in all modern telephone plants.

"Long-Saut" Clamps are made to conform to



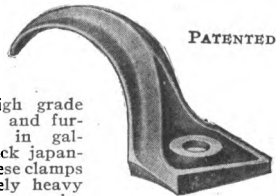
"Long-Saut" Clamps

543

every diameter of cable and may be used with or without bridle rings, as conditions require. Attached with Diamond Screw Anchors to brick, stone or concrete or with wood screws to wooden structures.

### DIAMOND MALLEABLE CLAMP:

For conduit, pipe and cable.



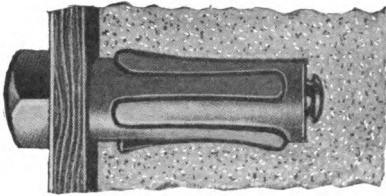
Made of high grade malleable iron and furnished either in galvanized or black japanned finish. These clamps are of extremely heavy design and they are intended for heavy duty.

Malleable Iron One Hole

## ESTATE OF F. H. EVANS

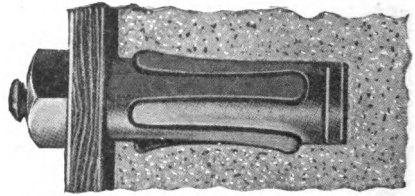
31-33-35 HEWES STREET, BROOKLYN, N. Y.

Manufacturers of the Evans Patent Expansion Bolt, Roofing Kettles, Asphalt and Mastic Pots, Pails, Buckets, Mixers, Heaters, Mops and Ladles for Roofers



No. 56

This Cut Shows How the Steel Fittings Expand and Hold when Bolt Is Screwed Down



No. 52

Work Fastened by Loose Nut Instead of Square Head Bolt

### CRESCENT EXPANSION BOLTS:

(Patented March 4, 1905.)

544 These expansion bolts are radically different from anything hitherto made—being the only ones expanding at both ends which are made in two parts—and the only one whose pliable metal bends and grips, or secures itself into the sides of the hole.

They are appreciated in places where it is not practicable or desirable to drill or bore through the material through which the fastenings are to be made and for such cases there is no other known method of doing the work so well.

Merely a straight hole, without flare, of sufficient diameter and depth to insert the bolt with nut and jaw is all that is required.

When bolted in place the greater the tension put on the bolt, the firmer the bolt will hold. However, when desired bolts may be removed with as much ease as put in.

The two styles shown here are the most commonly used but we make them with other style bolts such as machine screw, counter-sunk, stud, and with lengthening pieces to go deep in walls, ceilings, floors, etc.

#### Used for:

Fastening down bridge work  
Engine beds to masonry  
Cornices  
Fire Escapes  
Iron Railing  
Vault Lights  
Electrical Work  
Suspending Radiation and Coils for  
Steam Fitting  
Plumbing Fixtures  
Awning Irons  
Fire Escapes  
Ice Machines  
Marbles Works  
Iron Fencing

*Catalog sent upon request.*

## IRON CITY PRODUCTS COMPANY

PITTSBURGH, PA.

Manufacturers of the Double Worm Gear Rees Jack for Automobile, Truck, Railway and Industrial Uses

### REES JACK

The REES JACK has proven to be a most easily operated, convenient and efficient jack for automobile, truck, railway and industrial uses.

Because of the powerful leverage of their double worm gear drive REES JACKS have a maximum lifting power and dependability with a minimum of weight in the jack and requiring little effort at the handle.

#### Model No. 2:

The utmost simplicity marks the design of this 5 ton model REES JACK wherein the double worm gear drive affords great lifting capacity with minimum of weight and effort of operation.

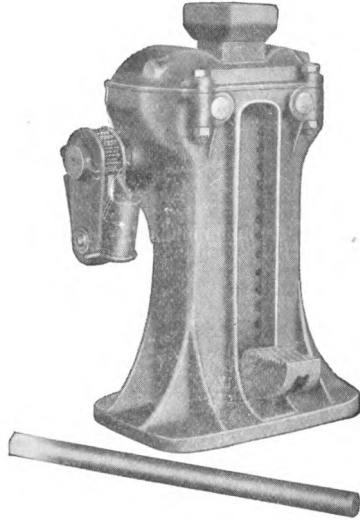
Height  $10\frac{3}{4}$ ", lift 6", weight 22 pounds, capacity 5 tons, list price \$20.00.

#### Model No. 3-A:

This model REES JACK is designed for somewhat heavier work than the number 2 and it is equipped with a foot lift which gives it a wider range of usefulness.

In common with the other REES JACKS it is extremely light in weight for its lifting capacity, lifts the load rapidly with small effort at the handle, holds the load safely at any point and raises or lowers it with steady hydraulic-like power.

Height  $12\frac{1}{4}$ ", lift 6", weight 28 lbs., capacity 6 tons, list price \$24.00.



545

#### Model No. 21-A:

This 10-ton model with foot lift won signal success in the tank and tractor fleet of the United States Armies abroad.

It is especially commended for use on mining cars, trucks and equipment wherever a jack of this capacity is required.

Height  $14\frac{3}{4}$ ", lift 9", weight 45 lbs., capacity 10 tons, list price \$45.00.

#### Model No. 33:

This model is designed for heavy use such as car inspection, removal of Journal brasses and all heavy industrial work.

Because of its moderate weight it is easily handled yet lifts the heaviest load easily with steady hydraulic-like power. Is thoroughly dependable under any circumstance and holds the load safely at any point.

Height 10", lift  $4\frac{1}{2}$ ", weight 46 lbs., capacity 25 tons, list price \$65.00.

# UNION SPRING AND MFG. CO.

GENERAL OFFICES

1207 FULTON BLDG., PITTSBURGH, PA.

WORKS: NEW KENSINGTON, PA.

BRANCH  
OFFICES:NEW YORK  
50 Church St.CHICAGO  
Fisher Bldg.RICHMOND, VA.  
Mutual Bldg.LOUISVILLE, KY.  
Todd Bldg.

Manufacturers of Coil and Elliptic Springs of All Kinds  
Pressed Steel Journal Boxes and Journal Box Lids, Steel Castings

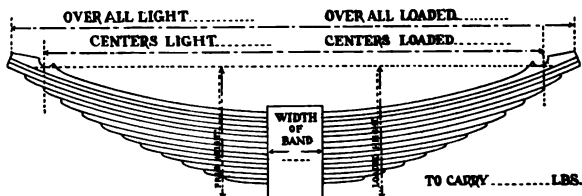
## SPECIFICATIONS FOR HALF ELLIPTIC SPRINGS:

DIMENSIONS OF  
SPRINGS

FOR.....

QUANTITY WANTED.....

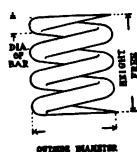
If solid height is not known give number of coils or pitch. These dimensions are equivalent.



546

NUMBER OF PLATES..... BAND..... SIZE OF STEEL.....X.....

## SPECIFICATIONS FOR HELICAL SPRINGS:



FOR.....

QUANTITY WANTED

Place a Cross (X) Opposite Kind of Spring Wanted

Single Coil Spring.....  
Double Coil Spring.....  
Triple Coil Spring.....  
Grouped in Plates.....

NOTE: If grouped in plates, please state the following:

Free height over plates.....

Number of Single or Double Coils per group.....

Enclose sketch or print of plate desired.

## Helical Springs

Item	Outer Coil	Middle Coil	Inner Coil
Outside Diam.			
Free Height			
Size of Bar			
Solid Height			
Number of Coils			
Loaded Height			
Load			
Capacity Solid			

## KENSINGTON JOURNAL BOX:



This box is made of pressed steel conforming to M. C. B. Standard sizes and specifications, as follows:

4 1/4" x 8"      5 1/2" x 10"

5 " x 9"      6 " x 11"

It is the strongest and lightest box, cannot be broken and absolutely oil tight.

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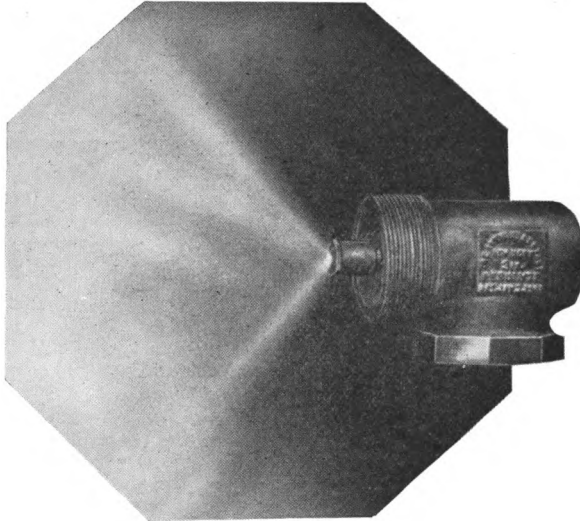
## THE ANTHONY COMPANY

138 WEST AVENUE, LONG ISLAND CITY, N. Y.

Liquid Fuel Engineers

---

Don't  
Waste  
Fuel



Consult  
Us

*A Perfect Mist of Oil*

547

### **ANTHONY NEBULYTE OIL BURNERS:**

Low and High Pressure Designs to Suit Every Requirement.

A Trial Proves Their Unequalled Operating Characteristics.

### **ANTHONY NEBULYTE OIL-GAS BURNERS:**

For Use with Either of These Fuels, or Both in Combination. No High Pressure Air Required.

### **ANTHONY CRUCIBLE FURNACES:**

Large Output, Low Operating Cost, Long Crucible Life.

Soft Flame, Small Shrinkage, Non-oxidized Metal.

### **ANTHONY RIVET FORGES:**

Compact, Portable, Economical, the Equal of Four Coal Forges.

### **ANTHONY OIL AND GAS BURNING EQUIPMENT:**

For Annealing, Hardening, Forging, Melting—All Purposes.

Designs Supplied at Reasonable Cost.

### **ANTHONY OIL AND GAS BURNING SYSTEMS:**

For Industrial Heating Processes.

For House Heating Uses.

### **ANTHONY NEBULYTE SPRAYS:**

For Water-Gas Machines.

For Any Other Purpose.

# AMERICAN INCANDESCENT HEAT CO., INC.

(Furnace Builders under Smallwood Patents)

10 POST OFFICE SQUARE, BOSTON, MASS.

Heat Treating Engineers

Furnace Contractors

## **SMALLWOOD STANDARD FURNACES:**

(600° F.-1800° F.)

SMALLWOOD STANDARD FURNACES are specially designed and built to meet definite requirements with laboratory exactness, operating at an unusually high thermal efficiency.

SMALLWOOD STANDARD FURNACES are built for all classes of heat treating work, including annealing, carburizing, hardening, and drawing.

SMALLWOOD STANDARD FURNACES when burning run-of-mine bituminous coal are hand fired or fired by mechanical stokers as local conditions may warrant.

SMALLWOOD STANDARD FURNACES may be operated on bituminous coal, fuel oil, illuminating gas, or producer gas without structural changes.

548

SMALLWOOD STANDARD FURNACES are built in multiple chambers having one to six working chambers operated from one combustion chamber.

SMALLWOOD STANDARD FURNACES are so designed and operated that the products of combustion entering the working chambers are commercially non-oxidizing thus reducing or eliminating the usual scaling.

SMALLWOOD STANDARD FURNACES are so designed that the working chambers are surrounded by canals effecting a high rate of production per square foot of hearth due to the effective heat reservoir of these canals.

SMALLWOOD STANDARD FURNACES show only a small proportion of the usual temperature variation when unloading and loading working chambers.

SMALLWOOD STANDARD FURNACES have an average cooling rate of less than 15 degrees F. per hour, due to their massive construction and effective heat insulation.

OUR ENGINEERS will be able to prove what we can accomplish in your plant.

YOUR ENGINEERS should investigate what we are already accomplishing in other plants.

OUR ENGINEERING DEPARTMENT is at your service for consultation work relative to heat treating equipment or entire heat treating plants.

## **SMALLWOOD RECUPERATIVE FURNACES:**

(1550° F.-2950° F.)

SMALLWOOD FURNACES of the recuperative type are designed for extremely accurate work in forging, drop stamping, copper refining, malleable casting annealing, plate and angle heating, billet heating, etc.

SMALLWOOD FURNACES of the recuperative construction are operated from integral gas producers or from central station gas producers at very high thermal efficiency.

SMALLWOOD FURNACES of the recuperative construction are so designed as to permit very accurate control of temperature, absolutely uniform heat, and an accurate control of atmospheric conditions in the working chamber.

SMALLWOOD FURNACES of the recuperative construction will show an unusually high rate of production per square foot of hearth because of the storage of heat in the recuperators, the massive construction and the heat insulation.

SMALLWOOD FURNACES of the recuperative construction show a very low maintenance charge due to the system of combustion which maintains a temperature throughout the recuperators very materially below that required in the working chamber of the furnace, the highest operating temperature being in the working chamber.

SMALLWOOD FURNACES of the recuperative construction reduce materially the labor charge for supervision whether operated from integral gas producers or central producer gas plants.

SMALLWOOD FURNACES of either the standard construction or recuperative construction will produce most accurate work and justify their investment on the following basis:

Interest on Total Initial Investment.....
Maintenance and Depreciation.....
Obsolescence.....
Insurance.....
Operating Labor Costs.....
Fuel Costs.....
<b>LOWEST TOTAL YEARLY COST.</b>

# AMERICAN INCANDESCENT HEAT CO., INC.

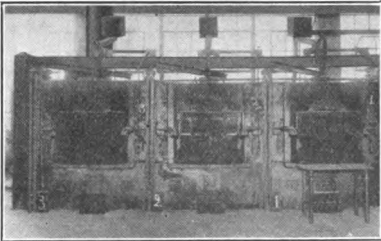
(Furnace Builders under Smallwood Patents)

10 POST OFFICE SQUARE, BOSTON, MASS.

**Heat Treating Engineers**

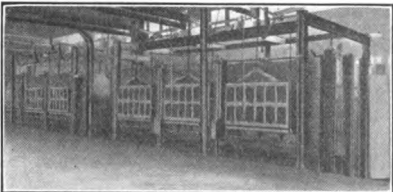
**Furnace Contractors**

## HEAT TREATING



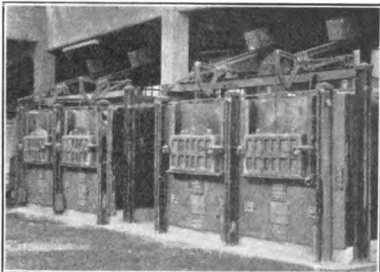
**Three Working Chambers, One Combustion Chamber**

## CARBURIZING AND HEAT TREATING



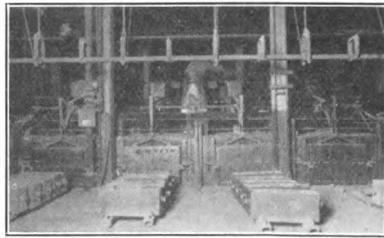
**Six Working Chambers, One Combustion Chamber**

## CARBURIZING



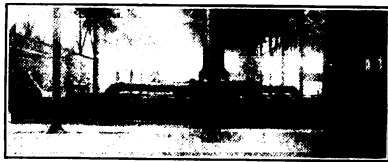
**Four Working Chambers, One Combustion Chamber**

## CAST IRON ANNEALING



**Four Working Chambers, Two Combustion Chambers**

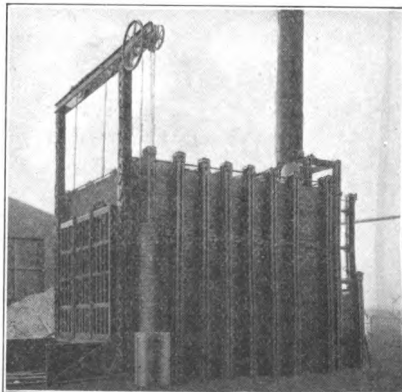
## COPPER AND BRASS ANNEALING



**Two Working Chambers, Two Combustion Chambers**

549

## STEEL CASTING ANNEALING



**One Working Chamber, One Combustion Chamber**

## W. N. BEST, INC.

11 BROADWAY, NEW YORK

Engineers in Caloric: Liquid Fuel Equipment; Furnaces for Heating, Melting and Heat Treatment of Metals. High Pressure, Low Pressure, Volume Air, Air Carburetting and Mechanical Burners of All Sizes

### W. N. BEST CALOREX LIQUID FUEL FURNACES AND EQUIPMENT:

*Twenty-seven Years' Experience in Handling Liquid Fuel. All Installations Guaranteed.*

Designs for changing coal-fired furnaces to oil-fired, for the remodeling of existing oil-fired furnaces, and the construction of all forms of furnaces for heating and heat treatment of metals.

If your present liquid fuel equipment is not in every way satisfactory, it can be remodeled to give perfect results. We guarantee entire satisfaction.

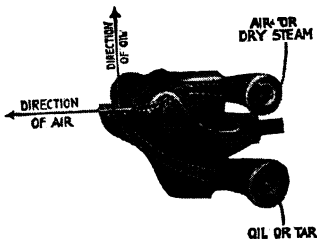
To secure 100% economy and 100% efficiency use W. N. Best Oil and Tar Burners for Annealing, Case Hardening, Tempering, Forging, Heat Treating, etc.

### W. N. Best High Pressure Burner Unmounted:

550

1. Note the direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally, which prevents clogging or carbonizing, the burner always being kept clean.

2. By releasing the set screw in yoke and raising the lip any obstruction that might find its way through the air line can be blown out.



High Pressure Burner

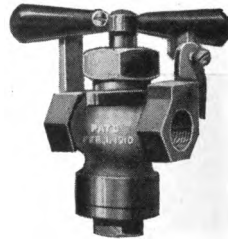
3. Air or dry steam from 15 pounds up can be used to atomize the oil.

4. The burner being in form of a syphon requires but very low oil pressure.

5. Burners can be fitted to throw either a long, narrow flame or a fan-shaped flame 9 feet wide, thus doing away with the necessity of using more than one burner in any fire-box or furnace that is 9 feet or less in width.

### W. N. Best Oil Regulating Cock:

This regulating cock is provided with a V-shaped, knife-edged opening in the plug, which not only has a shearing action on heavy liquid fuels, but enables the operator to secure the finest possible adjustment.

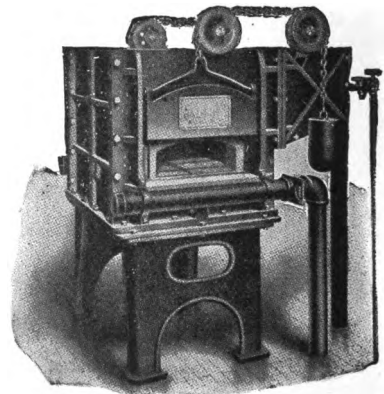


Oil Regulating Cock

When a furnace is working continuously on one class of work this cock can be set by the adjusting screw so that when the burner is stopped, it can be returned to the same adjustment when again started.

### Class "D" Forge Furnace:

Designed especially for drop forge work, but can be used for a wide range of heating, welding, tempering, etc. By placing a muffle in the charging space makes an ideal muffle furnace. Made with one or two charging openings.



Forge Furnace

The consuming fuel unites with the air necessary for perfect combustion in the combustion chamber before it reaches the charging space of the furnace—there is therefore no oxidation of the metal while being heated. The combustion chamber and arch are of such form and proportions that the flame and heat reverberate perfectly upon charging space of the furnace.

**CALOREX**



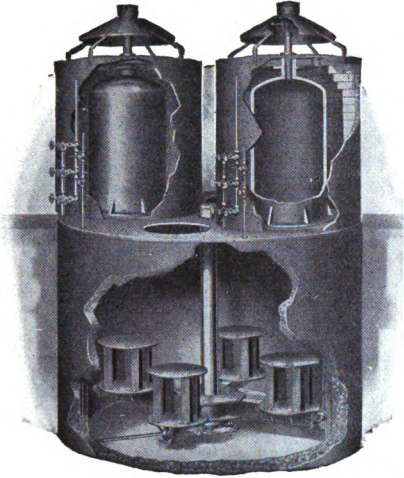


# CHARLES F. KENWORTHY, INC.

WATERBURY, CONN.

Builders of Industrial Furnaces

## HEAVY DUTY ANNEALING FURNACE:



"Bright" Anneals 5000 lbs. per charge. Vertical type—built in all sizes with single or double chamber.

Eliminates useless handling, pickling or washing of metals. No protection coating required.

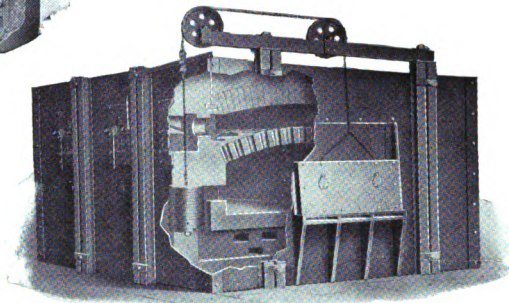
Many other types of nonoxidizing furnaces.

ASK FOR BULLETINS No. 83-N, No. 87-N.

KENWORTHY FURNACES  
GIVE  
THE BEST OF RESULTS

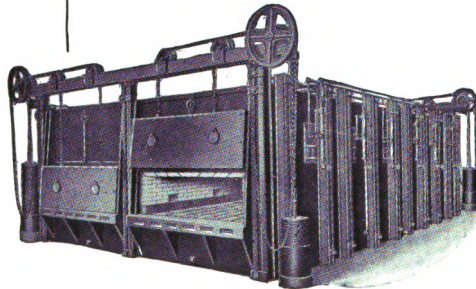
INDUSTRIAL FURNACES OF EVERY DESCRIPTION INCLUDING SHIPBUILDING, ANGLE OR BAR HEATING, ETC., ETC. ASK FOR BULLETIN NO. 82.

SIZES TO MEET YOUR SPECIAL REQUIREMENTS



551

No. 705 HEAT TREATING FURNACE: For all steel annealing, case hardening and heat treating operations.



TWIN DOUBLE END ANNEALING FURNACE: For annealing brass, copper and nickel silver products.

## THE ELECTRIC FURNACE COMPANY

GENERAL OFFICES: ALLIANCE, OHIO

WORKS:  
SALEM, OHIO

NEW YORK OFFICE:  
15 PARK ROW

**Manufacturers of Baily Electric Furnaces**

### THE RESISTANCE PRINCIPLE:

All Baily furnaces operate upon the resistance principle, which transfers heat by radiation and makes the most simple and rugged type of electric furnace in existence. The furnace chamber is built of special fire-brick. Resistor material of broken carbon fills a refractory trough that is made of carborundum fire-sand. Carbon electrodes carry the current into the trough, and make connection with resistor material, which causes it to glow like a huge incandescent lamp. Heat waves are radiated down equally upon all the metal on the hearth.

105 K. W. STANDARD TILTING TYPE furnace has a hearth capacity of 1500 pounds and a melting rate of 600 pounds per hour. The steel shell is 7' in diameter, is supported by cast steel brackets, and is tilted by a hand wheel mechanism attached to the side. This type is widely used to produce brass of the closest analysis and of minimum impurities, at a lower cost than any crucible, open flame, or reverberatory furnace, using coal, coke, oil, or gas as fuel.

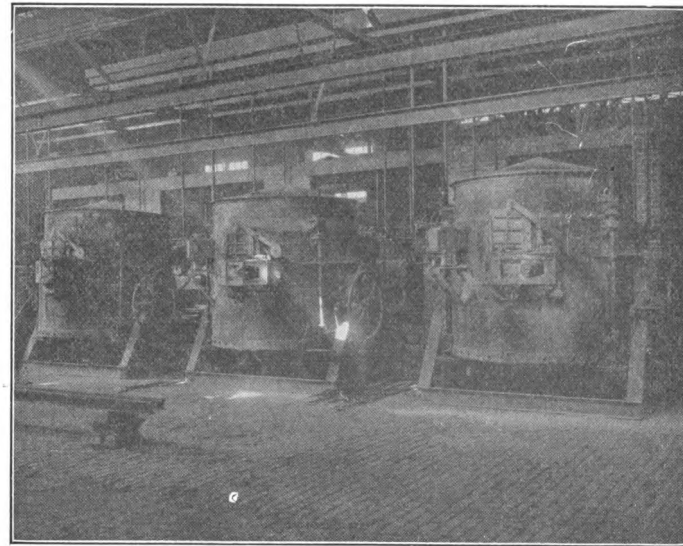
105 K. W. NOSE TILTING TYPE FURNACE is especially adapted for rolling mills and is arranged to pour the metal directly into the moulds. It is motor operated and has a motor operated casting table.

A larger 300 K. W. furnace of the same type has a hearth capacity of 5000 pounds, and a melting capacity of 2000 pounds per hour.

500 K. W. TAPPING TYPE, is a rectangular, non-tilting furnace for remelting aluminum pig in a non-oxidizing atmosphere. Hearth capacity of 3 tons.

The same type is built with 600 K. W. transformer capacity, and will melt brass at the rate of 2 tons per hour. Hearth capacity of 9 tons.

40 K. W. PITTYPE CRUCIBLE furnaces, a small type for melting precious metals. Crucibles are required, but they are especially protected and the furnace is tightly sealed to prevent the escape of metal vapors. This furnace is built in 40 K. W. capacity, using two No. 40 crucibles.



**105 K. W. Brass Melting Furnaces**

All sulphur gases, oxides, and other impurities are eliminated, and in this non-oxidizing atmosphere, furnace conditions may be controlled by standards of laboratory accuracy.

### BAILY ELECTRIC FURNACES FOR MELTING NON-FERROUS METALS:

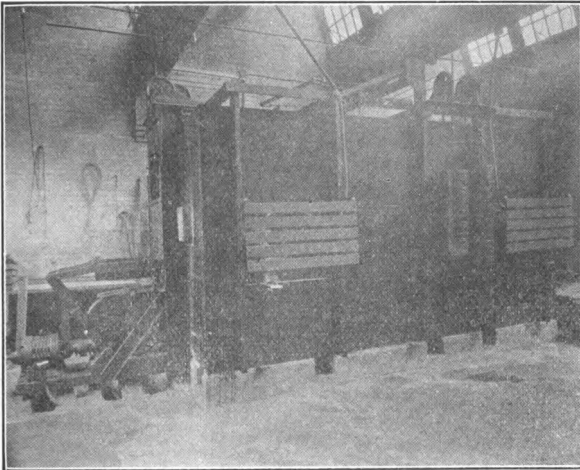
Built for Rolling Mills, Smelters and Foundries in Electrical Capacities: 40 K. W. to 1500 K. W. Hearth Capacities: 500 pounds to 200 tons, and melting rates of  $\frac{1}{3}$  Ton to 8 Tons per hour.

## THE ELECTRIC FURNACE COMPANY

### **DAILY ELECTRIC FURNACES FOR HEATING, ANNEALING, AND HEAT TREATING:**

Built for Rolling Mills, Foundries, Machine Shops, and Motor Car Plants, in Electrical Capacities: 150 K. W. to 1500 K. W., and Furnace Capacities:  $\frac{1}{2}$  ton to 10 tons per hour.

**SPECIAL TYPES** for PARTICULAR PROBLEMS—Baily engineers are ready to meet any metallurgical or heat treating problem, no matter how large or difficult it may be. Knowledge acquired through years of specialization in electric furnace construction, has made possible the building of many special type Baily Furnaces to meet the particular problems of various American Industries.

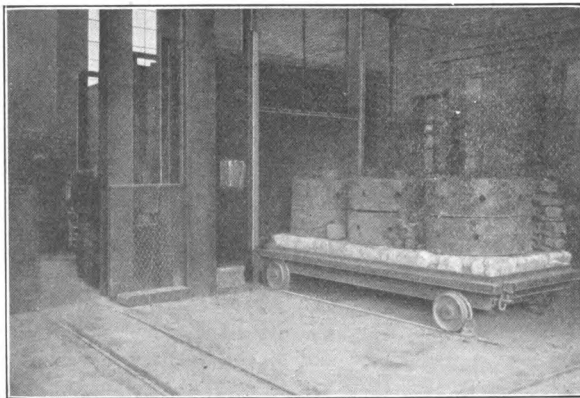


**150 K. W. Pusher Type Heat Treating Furnace**

**PUSHER TYPE** continuous furnaces are built in 150 K. W., 360 K. W. and 600 K. W. and 1500 K. W. sizes. The accurate temperature control of this furnace has met the most exacting standards in heating and annealing products of steel, copper, brass, and aluminum.

**AUTOMATIC CONTROL TYPE** continuous furnaces are built in 250 K. W. and 900 K. W. sizes, for heat treating either castings or forgings in quantity. This furnace will secure uniform annealing, tempering and quenching.

**CAR TYPE FURNACES** are built in 150 K. W., 300 K. W., and 600 K. W. sizes. Each size has demonstrated its service in annealing steel, copper, brass or aluminum.



**150 K. W. Car Type Furnace**

the various low tension voltages of the transformer may be readily impressed across the terminals of the furnace.

Any metallurgical or heat treating problems may be submitted for the careful consideration of special engineers.

**ELECTRIC FURNACE LABORATORY**—A modern laboratory at the Salem plant is completely equipped for testing alloys and solving difficult metallurgical problems.

**TRANSFORMERS**, of special design, wound for voltages 22,000 and under, are built by the Electric Furnace Company in its own plant for every Baily Furnace.

**SELECTIVE OIL BREAK SWITCHES** 553 are a necessary part of Baily furnace equipment. By this means any one of

## ELECTRIC FURNACE CONSTRUCTION COMPANY

402 FINANCE BLDG., PHILADELPHIA, PA.

FOREIGN OFFICE: T. H. WATSON & Co., LTD., KINGHOUSE, KINGSWAY, LONDON, ENG.

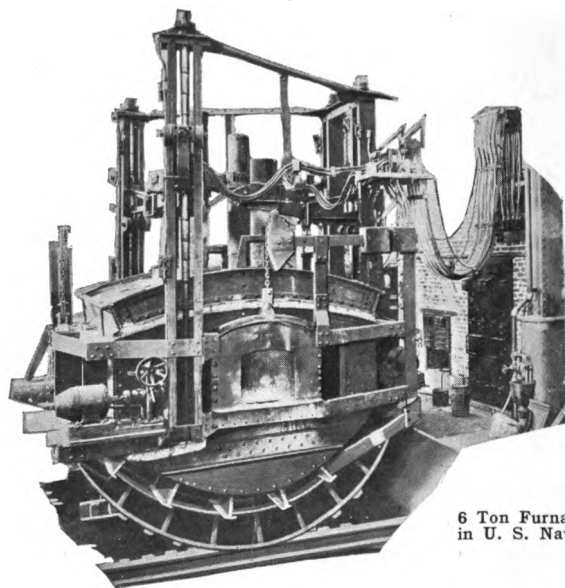
Designers and Suppliers of the "Greaves-Etchells" Electric Furnaces

**"GREAVES-ETCHELLS" ELECTRIC FURNACES** are manufactured in sizes ranging from  $\frac{1}{2}$  ton to 30 tons capacity. They are designed for hot and cold melting and refining. — Equally efficient either on acid or basic lining. — From comparative tests made with other electric furnaces, these furnaces have proved to be the most efficient and economical in operation of any type of electric furnace. — Its distinctive features are the resistive path and

—including a number of large furnaces for the United States Navy Yards, for the British, Spanish and Japanese Governments, and for many of the leading Steel makers in America and in Europe. In principle, it is an arc-resistance furnace and extremely rapid melting and refining is possible with a low power and electrode consumption.

The method of obtaining a balanced

554



6 Ton Furnace  
in U. S. Navy Yard

bottom heating. They are combined with a steady electrical load and high power factor. — The charge is evenly and uniformly heated, assuring perfectly homogeneous steel or castings, especially suitable for castings and alloy steels, as no chilling is possible on furnace hearth.

The "Greaves-Etchells" Furnace was introduced in 1914 and over sixty furnaces have been installed since that time

primary from either a two- or three-phase electrical supply, and the method of generating heat in the hearth of the furnace, together with many other mechanical devices, are protected by patents.

Also suppliers of electric furnaces for ferro alloy, calcium carbide, corundum and brass melting.

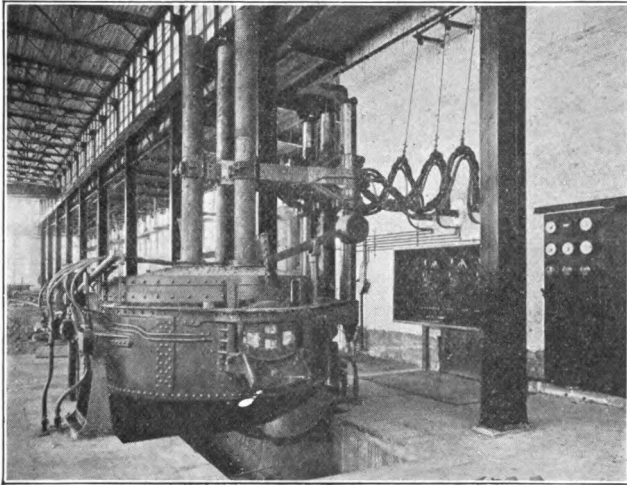
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# PITTSBURGH ELECTRIC FURNACE CORPORATION

PITTSBURGH, PA.

**Manufacturers of Moore Rapid Electric Furnaces for Tool Steel, Alloy Steels, Forging Steels, Malleable Iron, Fine Cast Iron, Brass, Non-ferrous Metals, Calcium Carbide, etc.**

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**FOUNDRY FURNACE INSTALLATION**

## **MOORE 'LECTROMELT FURNACE:**

**The Most Rapid**

**The Greatest Output**

**The Most Efficient**

**The Most Economical in  
Operation**

Moore 'Lectromelt Furnaces have proven their superiority for rapid melting and refining high quality steels and irons. They are particularly adapted for use in steel mills and foundries where they effect marked economies and produce superior grades of product.

They are electrically designed to furnish ideal balanced, three phase, high power factor, long hour central station load.

Every important improvement in furnace design has been combined in this furnace, to increase output, reduce power consumption, perfect operation, improve quality, and reduce cost of product.

Standard sizes of steel furnaces range from 200 pounds to 12 tons per heat. Brass and non-ferrous metal furnaces range from  $\frac{1}{8}$  ton to one ton capacity per heat.

**MOORE RAPID 'LECTROMELTER  
THE FURNACE OF QUALITY**

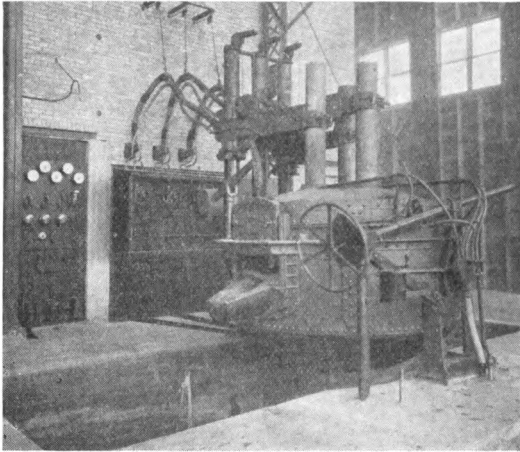
## PITTSBURGH FURNACE COMPANY

PUBLIC SERVICE BLDG.

MILWAUKEE, WISCONSIN

**Manufacturers of Electric Arc Furnaces for Melting Steel, Malleable and Gray Iron  
For Acid or Basic Operation**

MOORE PATENTS



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3 Ton Furnace and Control Panel

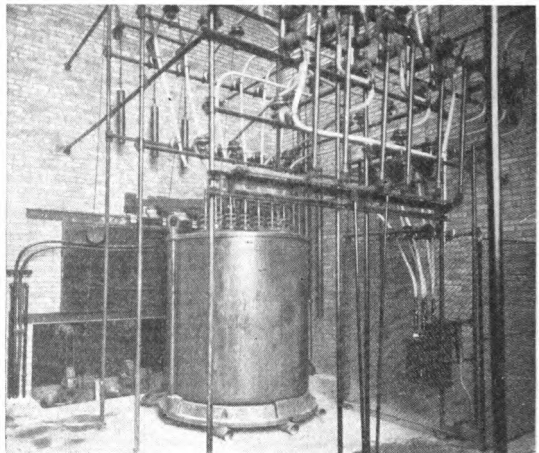
**THE PITTSBURGH ELECTRIC FURNACE** is designed for the use of three carbon electrodes entering the roof vertically and electrically connected to operate on a balance, poly-phase circuit. This arrangement not only produces the most uniformly distributed load on all three phases, but embodies the most economical arrangement and use of electrodes. The neutral bottom tap on the furnace permits each electrode to strike its arc without waiting for other electrodes to come

into contact with the charge and materially aids to smooth out the current surges and quicken the melt. A high power factor is also obtained. Automatic electrode regulators are supplied with all sizes of our furnaces.

The Pittsburgh furnace is made in 1600 lb., 1½ ton, 3 ton, 6 ton, and 12 ton sizes.

On acid operation these furnaces will make a heat in 1¾ hours.

*Write for Bulletin.*



Transformer and Substation Equipment

# W. S. ROCKWELL COMPANY

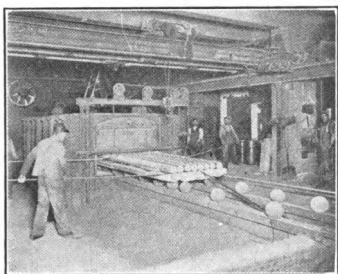
50 CHURCH ST., NEW YORK

(Hudson Terminal Bldg.)

Furnace Engineers and Contractors

## COMPLETE INDUSTRIAL FURNACE EQUIPMENT:

OIL—GAS—COAL



Car and Ball Type Annealing Furnace

"FURNACE AND FUEL TO SUIT THE WORK"—is the rule governing our consideration of a new or the improvement of existing furnace equipment to suit **your** needs under **your** plant conditions. Our purpose is to deal with each case on its individual merits and to recommend changes in methods or equipment only when it is apparent that these will be productive of better results.

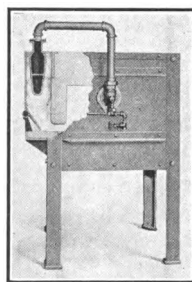
We do not merely sell furnaces, but rather means for efficiently producing results in industrial heating operations, which involves a great deal more than combining brick and iron or the burning of fuel.

## "ROCKWELL SERVICE" SOLVES HEATING PROBLEMS:

We make inspection of plant devise methods and means of working, prepare plans, furnish complete industrial furnace equipment and guarantee results, using coal, gas or oil, as the best interests of our patrons require.

The following list of furnaces and appliances illustrates the variety of work we do and our familiarity with furnace and fuel problems:

Angle Heating Furnaces  
Annealing Furnaces  
Billet Heating Furnaces  
Blast Gates, New Air-Tight  
Blowers  
Carbonizing Furnaces  
Cyanide Furnaces  
Drying Furnaces  
Enameling Furnaces  
Forging Furnaces  
Fuel Oil Appliances  
Hardening Furnaces  
Heat-Treating Furnaces  
Heating Furnaces  
Lead Pot Furnaces  
Melting Furnaces  
Muffle Furnaces  
Plate Heating Furnaces  
Rivet Furnaces  
Rivet Rod Furnaces  
Spring Fitting Furnaces  
Soft Metal Melting Furnaces  
Stoker Fired Recuperative Furnaces  
Scaling Furnaces  
Tempering Furnaces  
Upsetting Furnaces  
Varnish Boiling Furnaces  
Wire Furnaces

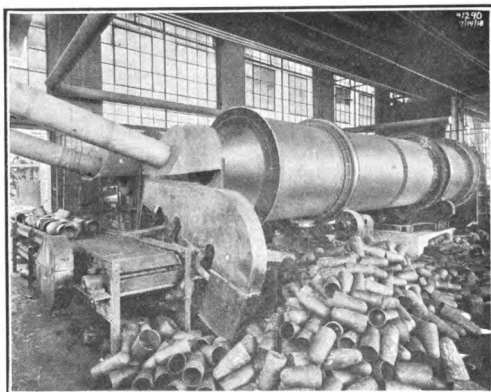


Economizer Forge Furnace Showing Deflection of Spent Gases to Preheat Air for Combustion

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Write for catalog



Rotary Annealing and Heat-Treating Furnace



## TATE-JONES & CO., INC.

Furnace Engineers

Established 1898

PITTSBURGH, PA.

NEW YORK

CHICAGO

SAN FRANCISCO

ST. LOUIS

BUFFALO

Manufacturers of All Types of Heat-Treating Furnaces

Tate-Jones & Co., Inc., design and build furnaces of every type for every possible use in the heat treatment of ferrous metals.

Every furnace represents the accumulated experience and scientific study of more than 20 years. That this is profitable to the furnace user is well proven by the remarkable success secured with Tate-Jones Furnaces. They are at work in every steel-producing center in the world.

Our experience has proven that appropriately distinctive types are necessary for different work. It is highly important that the proper type be selected. In this, our judgment is of inestimable value to the furnace user as this judgment is the outcome of recorded scientific research. It is the result of intimate, practical association with the various heat-treating processes.

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Tate-Jones Furnaces are simply constructed. Only the best well-proven materials are used. They are designed in accordance with the latest accepted engineering practice.

They have established a reputation for unusual dependability. They are noticeably economical of fuel and so constructed that they save human labor and effort wherever possible.

We will gladly send our booklet—"Heat Treatment of Steel" to those interested. We have bulletins and information concerning the various furnaces, burners, etc. In writing, state the character of the work you do so that we can send the proper literature.

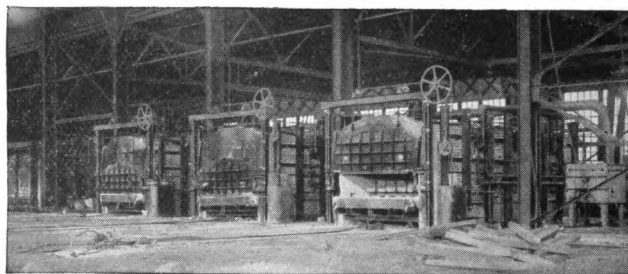
That Tate-Jones Furnaces have been carefully designed, and are constructed to meet the most exacting requirements as to temperature control and fuel consumption will be proven by the following:

When the Tate-Jones Improved Gas Oven Furnaces were first contemplated a series of tests was run on all of the different furnaces then on the market. It was only after nine months of painstaking experimental work had been done, during which time many heats were run and hundreds of readings taken, that Tate-Jones perfected the design of the gas oven furnace.

In making a comparison between this Tate-Jones furnace and others, the standard of comparison was 100 cubic inches of space available for work. The temperature of the furnaces was observed at six points: combustion chamber, heating chamber, vent, outer casing, and at two points in the side wall. Temperatures were read with the furnaces in equilibrium, that is, when linings, casing, etc., had absorbed the maximum amount of heat.

The Tate-Jones Gas Oven Furnace used less gas to bring it up to 1600° temperature, and also considerably less gas to maintain it at 1600°. In fact it operates on 33½% less fuel than its nearest competitor. Tests of 1300°, 1450° and 1800° all gave similar results.

These remarkable findings are backed up by data and figures which are available to anyone interested.





# TATE-JONES & CO., INC.

Furnace Engineers

Established 1898

PITTSBURGH, PENNA.

NEW YORK

CHICAGO

SAN FRANCISCO

ST. LOUIS

BUFFALO

Manufacturers of All Types of Heat-Treating Furnaces

## FUEL OIL BURNING EQUIPMENT FOR OPEN HEARTH FURNACES:

With proper burners and equipment, oil is an ideal fuel for open hearth steel furnaces. It is the cheapest fuel except in the immediate neighborhood of coal and natural gas fields. The heat of the furnace is more easily regulated with oil than is possible with producer gas. A lower grade of scrap may be used with oil fuel than with producer gas, or with the same grade of scrap a better quality of castings is produced. Therefore, even where natural gas and coal are abundant we are installing oil burning equipment. We have also been installing many auxiliary systems. A fuel oil auxiliary equipment does not in any way interfere with the operation of the furnaces with the regular fuel, but is ready at a moment's notice when needed.

The first cost of an oil-burning installation is very much less than a gas producer plant, and with oil there is practically no extra labor required. The maintenance and depreciation cost are so low as to be negligible. With gas producers these items are very large. The repairs of the furnaces using oil fuel have been found to be very much less than with producer gas.

The necessary apparatus for one open hearth furnace consists briefly of two burners, one for either end of the furnace; a reversing valve stand located back on the charging floor for reversing the flow of the oil; and the atomizing agent as the furnace is reversed. A pumping, heating and regulating system is also necessary. This draws the oil from the oil storage tank and feeds it to the burners under constant and uniform pressure. A reducing valve for reducing the compressor or boiler pressure and the necessary pipe, valves, and fittings, together with the oil storage tank, complete the equipment required.

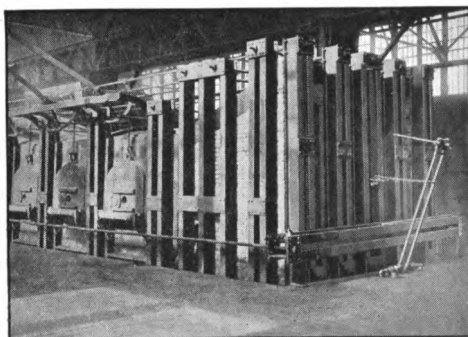
Send for descriptive literature telling you valuable facts about oil burning costs and advantages.

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## GUARANTEED INDUSTRIAL FURNACES:

Tool Dressing  
Flue Welding  
Blacksmith  
Rivet Heaters  
Bolt Heading  
Nut Punching  
Pipe Bending  
Continuous Rod  
Small Forging  
Heavy Forging

Drop Forging  
Plate Heating  
Flanging  
Annealing  
Tempering  
Pack, Case, Lead and  
Cyanide Hardening  
Bench Forges  
Special Processes



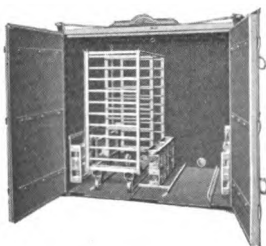
# THE OVEN EQUIPMENT & MFG. CO.

NEW HAVEN, CONN.

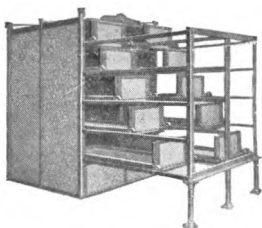
Manufacturers of Crawford Sectional Ovens and Enclosed Flame Gas Burners

## "CRAWFORD SECTIONAL"

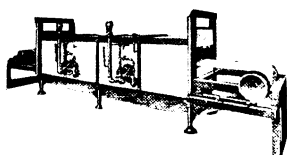
OVENS are used for the following heating processes: Baking enamels and japans in all colors and heats; vulcanizing hard rubber and substitutes; baking and drying food products, armatures, insulated wire, cores, molds, and abrasives.



Type 2 Electric Oven



Drawer Oven



Flat Conveyor Oven

## "CRAWFORD SECTIONAL" OVENS

are heated with our **ENCLOSED FLAME GAS BURNERS, ELECTRICITY, OR STEAM.**

## STANDARD TYPE OVENS:

These ovens are built in every size which industrial needs demand. Goods may be handled on racks, trucks, or over-head rails. The simple, rigid design for taking care of the expansion and contraction, the high grade of insulation used, positive air circulation, and accurate temperature control—all insure durability and continued successful operation with the maximum economy.

## SPECIAL OVENS:

Sectional construction and standardized units lend themselves very readily to the fabrication of special ovens. Our engineering service is always available for the discussion of equipment to meet individual requirements; our knowledge, gained from long experience with oven problems of every kind, is entirely at the disposal of our customers.

## CONVEYOR OVENS:

Quantity production can be speeded up to the highest point by the use of our flat or vertical conveyor equipment. We build these ovens in a variety of sizes to facilitate rapid continuous baking.

## TRUCKS:

We build all-steel *OVEN TRUCKS* with roller bearings.

# AMERICAN METAL TREATMENT CO.

ELIZABETH, N. J.

Case-Hardening, Annealing, Hardening, Tempering, Coloring, Etc.

## Our Specialties:

CASE-HARDENING      HARDENING  
ANNEALING            TEMPERING  
GUN METAL COLORING, ETC.



Fractured Ball Race

We case-harden in bulk parts in the following lines:

Adding Machine Parts  
Ball Races  
Bushings  
Cams  
Canning Machine Cams  
Gears, Spur Bevel and Worm  
Hoisting Engine Parts  
Pins and Shafts  
Printing Press Parts  
Rolls for Various Purposes  
Screw Machine Products  
Sprockets  
Stampings of all kinds  
Typewriter Parts



Solid and Hollow Spindles for Screw Machines, Lathes and Grinding Machines, Wrist Pins and Sleeves for Auto-

mobile Engines and the largest Stationary Engines.

## Improved Method of "Local" Case-Hardening:

Our method of local case-hardening makes it unnecessary to protect piece by banding or coating the portions desired soft; and it reduces warping. The blank is roughed out to grinding limits at the places to be hardened. After carbonizing—the carbonized skin is removed from the "soft places." The piece is now heated and quenched at the desired temperature. The "soft places" can now be machined to size.

If you have a proposition adapted to that treatment call upon our engineering staff for recommendations and advice.

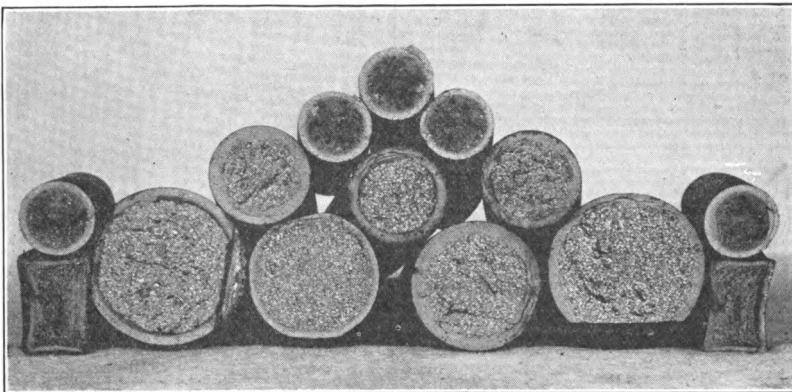
## "Carbonia" Finish:

"Carbonia" Finish is a kind of Gun-Metal finish for steel and iron parts, though of a deeper, richer black than the average Gun-Metal.

"Carbonia" was first applied to clothing buttons and buckles, then harness and saddlery hardware. It has been adopted by nearly all of the larger fire-arms manufacturers of the country and now is used on electrical, typewriter and adding machine parts. It is also applicable to the humbler metal goods—such as shoe-lace tips, etc.

This finish is not rust-proof; but is a very good protector.

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Samples of Case-Hardening by the Gas Process

## KASENIT COMPANY

11 WATER STREET, NEW YORK

**Manufacturer of the Purest, Most Rapid, Uniform and Effective Case-Hardening Compound on the Market for All Kinds of Iron and Steel, Non-Poisonous, Non-Explosive, Non-Inflammable**

The work in the hardening shop should be controlled and regulated in a similar way to the work in the machine shop, and in this connection the hardening material corresponds to the cutting tool of the machine. If the tool is of poor quality the output suffers, but with a good tool or a good case-hardening material best results are assured.

Case-hardening material **MUST BE RELIABLE** and to ensure this it must be controlled and uniformly secured. This has been established in the manufacture of the



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### CASE-HARDENING COMPOUNDS

#### Open Fire Case-Hardening:

**"KASENIT" No. 1** is a very refined, rapid powder suitable for delicate and highly finished work, carbonizes the work rapidly and uniformly, and after quenching, the surface is beautifully clean, and perfectly hard. Recommended for workshops, experimental work, and repair shops where speedy and safe results are studied.

**"KASENIT" No. 2** contains very largely the same constituent parts as No. 1 but in a less chemically refined state. It has all the good working qualities, though for the reason stated it can be supplied at a lower price, and is recommended for large users and manufacturers.

In its mechanical action nearly every case-hardening compound, except those consisting of an overwhelming percentage of dense inert material, shrinks considerably under heat, endangering the work in the upper part of the boxes and in many cases the whole of the work.

In **"KASENIT"** the constituents are arranged so that there are always certain ingredients capable of expansion to fill any gap occurring by other ingredients being reduced to ashes under a high heat.

The richness of carbon in **"KASENIT"** also accounts for the fact that a comparatively small amount of it, compared with other materials, is required to do the same work, and in addition, owing to its being light in weight, **"KASENIT"** is extremely economical in practical use.

#### For Oven Work:

**"KASENIT" No. 4** is a carbonizing powder for used in closed boxes under a long exposure of heat.

The raw materials of which **"KASENIT"** is composed have all been chosen for certain purposes and in order to bring about the most favorable mechanical conditions, thereby avoiding the evil influence of a large amount of air which is necessarily in the box when a coarse-grained compound is used.

**"KASENIT"** in bulk provides 61 cubic feet to the ton (twice the volume of good raw bone) and does not shrink when heated. Its utility may be repeated by adding a percentage of new material.

#### KASENIT No. 1

Sold in ½ lb., 1 lb., 3 lb., 5 lb. and 10 lb. tins.

#### KASENIT No. 2

Sold in 25 lb., 50 lb. and 100 lb. kegs.

#### KASENIT No. 4

Sold in 100 lb. bags.



*35 page booklet on up-to-date methods of case-hardening sent on request.*

## **ELECTRIC ARC CUTTING AND WELDING COMPANY**

222 HALSEY STREET, NEWARK, N. J.

**Manufacturers of Portable Electric Alternating Current Apparatus  
for Cutting and Welding Metals**

Of the many welding, cutting and repairing apparatus in use none have been able to combine accuracy and certainty of operation, low first cost and maintenance and convenience to the operator. Now, however, painstaking research and experimentation have been rewarded in the simple, thorough and reliable apparatus designed by the Electric Arc Cutting and Welding Company.

We have selected alternating current in preference to direct current as it gives constant voltage, constant current and therefore constant heat. We have selected a special type transformer with no moving parts as the most economic from the point of purchase price, weight, maintenance and electrical efficiency.

It requires but  $1\frac{1}{2}$  to  $2\frac{1}{4}$  kilowatt hours for our apparatus to deposit a pound of mild steel. How many other

### **POWER SUPPLY:**

Our machine can be designed to meet any power supply, but would recommend nothing above 550 volts on the primary circuit. It is made single phase. No expensive cables; standard wire is all that is required as wiring is done on primary side.

### **MAINTENANCE:**

As the life of our apparatus is practically indefinite it need never be replaced unless through careless handling or accidental injury. This cannot be said of motor generator sets as their many moving parts may mean 100% depreciation in a few months.

### **PENETRATION:**

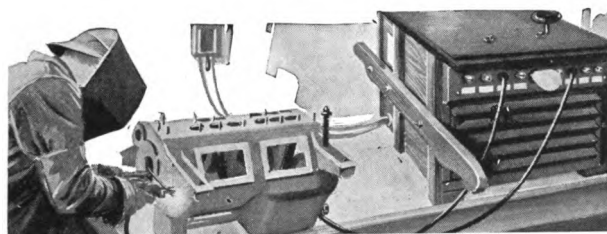
Our machine is the first one which has proven satisfactory in the cutting and welding of cast iron and the welds made of cast iron by our apparatus are guaranteed, provided the original cast iron is the same cross sectional area as the weld. Other characteristics in that our

machines excel is the smooth deposition of the metal, its greater ductility and elongation and the absence of electrolytic corrosion which takes place in a D. C. welding apparatus.

### **USES:**

This machine can be furnished for either cutting or welding or both in the one machine. Its applications are numberless, saving the cost of replacements and the cost of shutting down the plant for replacements.

We will be pleased to furnish you with literature, catalogues and engineering service to help you solve your welding problems.



welding sets can show the same performance?

### **PORTABILITY:**

Our machine in its 60 cycle type weighs but 260 pounds and is really portable, compact and easy to handle. Compare this with the advertised portable motor generator sets with switchboards, base, starting apparatus, heavy chassis, wheels, etc. Manufacturers have attempted to lighten these generator sets but the apparatus has suffered in the fragility of its parts.

Another advantage of our machine is that it may be placed right side up, upside down or upon its sides and function perfectly.

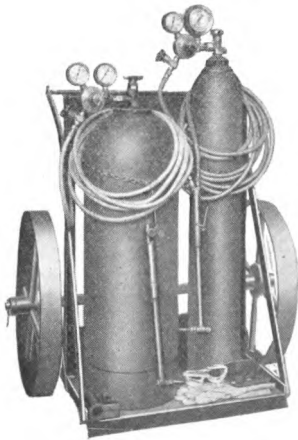
## **K-G WELDING & CUTTING CO. INC.**

556 WEST 34TH STREET, NEW YORK CITY

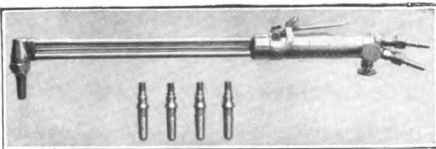
'Phone 6358 Greely

**Manufacturers of  
COMPRESSED GAS WELDING  
AND CUTTING EQUIPMENT**

Contractors  
for field and shop, Oxy-Acetylene  
welding and cutting of all descriptions.



**COMPRESSED  
OXYGEN AND ACETYLENE**



**Oxy-Acetylene Cutting Torch  
with 4 tips.**

**Welding Torches with 8 tips, suitable  
for all ordinary requirements.**

**Oxy-Acetylene Manufacturers' Welding  
Torch with 4 tips. This is a small torch  
for very fine or light welding.**

**Cutting Torch with 4 tips, which can be  
used with most any carbon gas in combi-  
nation with oxygen.**

**Pressure Regulating Valves.**

**Decarbonizing Equipment.**

**Jewelers' Platinum Torches.**

**Kerosene Preheating Torches, etc.**

**Acetylene Gas Generators.**

*Approved by the Underwriters Labora-  
tories of Chicago as a fire and accident risk.*

Complete equipment for cutting and  
welding, or complete equipment for either  
cutting or welding and all supplies neces-  
sary for this line of work. We are also  
a supply station for oxygen and acetylene.

Prices and catalogue and any informa-  
tion furnished on request.

# THE ALEXANDER MILBURN COMPANY

BALTIMORE, MD.

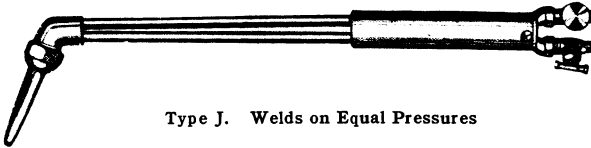
NEW YORK  
51 E. 42nd St.

CHICAGO  
1012 Kimball Bldg.

PITTSBURGH  
406 Bessemer Bldg.

SAN FRANCISCO  
1037 Monadnock Bldg.

Manufacturers of Oxy-Acetylene Welding and Cutting Apparatus  
and Portable Carbide Lights



Type J. Welds on Equal Pressures

## THE MILBURN QUICK-WELD TORCH:

The Milburn Quick-Weld Torch welds on equal pressures of oxygen and acetylene. On heavy welding the amount of oxygen needed is just half that demanded by the ordinary torch. Oxygen is an expensive part of any welding operation. By cutting the oxygen consumption in half you cut down your welding costs. The Milburn Quick-Weld does not save oxygen at the expense of the job; in fact, it produces quicker, more perfect work than old style torches.

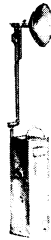
## THE MILBURN CUT-WELD TORCH:

This Cut-Weld Torch changes from a welder to a cutter at a moment's notice by a simple change of tips. It is not necessary to change hoses or to make any other adjustments. Merely change the tip and press the oxygen thumb-button. This thumb-button is equipped with an automatic catch which holds the button down, giving a constant flow of oxygen if desired. Trip the catch and oxygen is cut off immediately.

*For complete information regarding the Milburn cutting and welding apparatus write for booklet No. 335.*

## MILBURN PORTABLE LIGHTS:

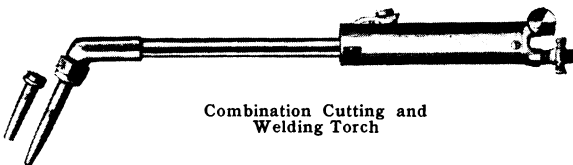
For night illumination there is nothing as satisfactory as Milburn Portable Acetylene Lights. For construction work, railroads, mines, quarries, locomotives, or farm tractors the Milburn lights have proved both efficient and economical. These lights range in size from the small No. 22 light which gives 100 candle-power to the large industrial flood light like the No. 12 which gives 15,000 candle-power. They use ordinary lump carbide which can be purchased anywhere.



565

Whatever kind of night work you are engaged in there is a Milburn light to give you sufficient and economical illumination.

*(Write for booklet No. 235.)*



Combination Cutting and  
Welding Torch

## QUASI-ARC WELTRODE CO., INC.

ATLANTIC AVE. AND WARWICK ST.

BROOKLYN, NEW YORK

Agents in Principal Cities

BRANCHES IN

LONDON

PARIS

GENOA

LISBON, ETC.

**Manufacturers of Quasi-Arc Patented Slagged Electrodes for Electric Welding, and Manufacturers and Dealers in Electric Welding Apparatus. Patentees of Designs and Methods for Welded Ship Construction**

The principal advantages of the **QUASI-ARC SYSTEM** over the older methods of autogenous welding—such as oxyacetylene (or other gas), carbon-arc, and bare-wire metallic—are these:

1. Simplicity, portability, and low cost of the apparatus required.

2. Either Direct, or Alternating Current at line voltage may be used with equal success, thus eliminating the expensive and inefficient "welding-generator."

3. Deposited metal protected from oxidation during the welding operation, by the fused slag which covers it.

4. Resulting purity and fine grain of the deposited metal permits of bending, caulking, or machining.

5. Welds have high tensile strength, and are from 2 to 10 times as strong, under "live" loads, as welds made by other methods.

566

6. The extremely short arc, and concentration of heat (due to the insulation of the electrode) materially reduce the current required; and effect remarkable penetration, without the distortion and "grain-growth" common to other methods.

7. The deposited metal, owing to its purity, is electro-negative, and will not corrode.

8. The correct welding temperature is automatically secured by the wide range in size of the electrodes, thus avoiding unfused or burned spots in the weld.

9. Special electrodes for overhead work; and alloy steel electrodes for the repair of High-Carbon steel, High-Manganese steel, etc., etc.

### RECENT RESEARCH AND DEVELOPMENT:

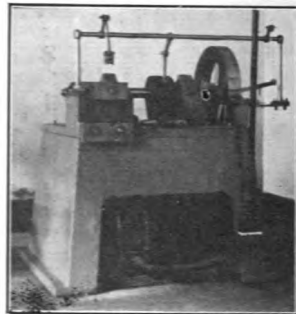
In the past two years the art and methods of autogenous welding have been more thoroughly studied, and more rapidly developed, than in its whole previous history. Realizing its enormous possibilities in ship-construction and munition-manufacture, the leading scientific bodies of America and Europe have carried out investigations to determine by what methods welds could be made which would safely carry "live" loads.

The **QUASI-ARC SYSTEM** is the only one which has successfully passed the exacting tests prescribed by the Technical Committee of Lloyd's Register of Ship-

ping, and is the only method which has been permitted in the building of the "rivetless ships."

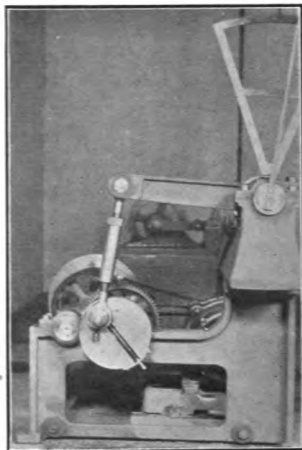
To reproduce the strains of "live" loads, the machines shown below have been developed:

#### Impact-Bending Machine



In this test Quasi-Arc welds stand from 2 to 4 times as many alternations as those made by other methods.

#### Alternating Torsion Machine



In this test Quasi-Arc welds show from 5 to 10 times the life of other welds and test-pieces often break outside the weld.

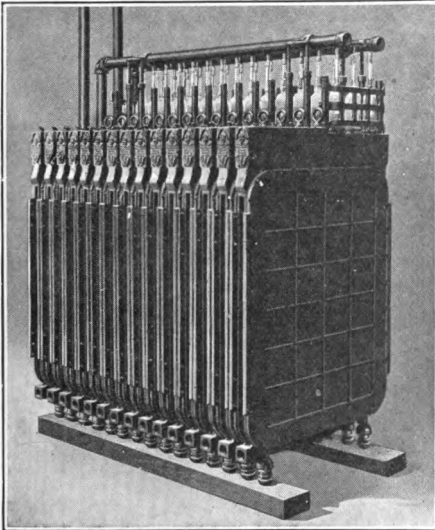
We shall be pleased to make welding demonstrations, physical tests, and metallographic examinations in our laboratories for interested parties; and welcome work found impossible by other systems of welding.



# INTERNATIONAL OXYGEN CO.

NEWARK, N. J.

**Manufacturer of Generators for Oxygen and Hydrogen; Pressure Regulating and Reducing Valves for High Pressure Gases; Gas Testing Apparatus and Cylinders; Distilling and Hydraulic Testing Apparatus; Oxygen and Hydrogen Gases in Cylinders**



**Bank of 15 I. O. C. Type 4—1000 Oxy-Hydrogen Generators**

## I. O. C. TYPE 4—1000 OXY-HYDROGEN GENERATOR:

These generators of the unit or single cell type have set a new standard of economy in gas production.

Each generator is complete in itself, making pure oxygen and pure hydrogen at a rate determined by the amperage of the electric current supplied.

Each unit requires floor space of 4' x 40' and with necessary pipe connections needs head-room of about 6 feet. This generator per unit of floor space produces normally three times the gases made by any other apparatus.

Practically no organic material enters into the construction. There are no parts on the interior of the cell constructed of glass, porcelain, rubber or paraffine which are readily destructible. I. O. C. cells are indestructible and time-proof.

### ELECTRICAL EFFICIENCY:

At normal current of 600 amperes, each cell, with an electrolyte of caustic soda solution, requires 2.2 volts and has a guaranteed capacity of 4.8 cu. ft. of oxygen and 9.6 cu. ft. of hydrogen per

clock hour. The kilowatt hour efficiency is 3.65 cu. ft. of oxygen and 7.3 cu. ft. of hydrogen.

A normal current of 600 amperes is stated because, at the common current rates, the cell operated at this amperage shows the most economical adjustment between installation cost and operating cost.

Below 600 amperes, a slightly higher electrical efficiency is obtained but the gas output per cell diminishes. Above 600 amperes, the electrical efficiency diminishes slightly while the output per cell increases.

When the demand falls below normal, current can be saved by running the plant on a lower amperage, thus securing the smaller gas output needed at a higher electrical efficiency. As gas requirements increase, a higher amperage can be used and a larger output secured.

It is practical to operate, at a range, from less than 200 amperes to upwards of 1000 amperes—or at a ratio of more than 1 to 5.

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### Capacities—I. O. C. Type 4—1000 Unit Generator

No. of Cells	Capacity in cu. ft. per 24 Hours			
	At 600 Amperes		At 1000 Amperes	
	Oxygen	Hydrogen	Oxygen	Hydrogen
25	2880	5760	4800	9600
50	5760	11520	9600	19200
75	8640	17280	14400	28800
100	11520	23040	19200	38400
150	17280	34560	28800	57600

### PURITY OF GASES:

I. O. C. Type 4—1000 Generators are guaranteed to produce gases of a minimum purity of 99% for oxygen and 99.5% for hydrogen. Experience, however, shows oxygen averaging 99.7% pure and hydrogen 99.9% pure.

### I. O. C. ENGINEERING SERVICE:

The Company designs, installs and puts into operation oxy-hydrogen plants complete in every detail—not alone I. O. C. generating apparatus but also such purchased accessories as motor-generators, switchboards and control apparatus, compressors, gas holders, piping systems, and apparatus for utilizing the gases.

Or the Company will, in connection with the purchase of its own apparatus, prepare plans for the complete installation and furnish specifications covering all accessories.



**CATALOGUE SECTION**  
**PART VII**

**Compressors, Fans, Blowers**  
**Pumping and Hydraulic Machinery**  
**Crushing and Drying Machinery**  
**Engineering Miscellany**

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**Pages 571-684**



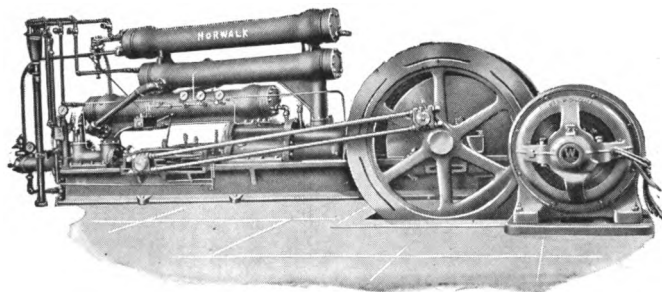
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# THE NORWALK IRON WORKS CO.

SOUTH NORWALK, CONN.

Pioneer Builders of Compressors for Air, Oxygen, Hydrogen, Acetylene,  
Carbonic Acid Gas

---



24-inch Stroke Chain-Driven Four-Stage Air Compressor

## NORWALK AIR AND GAS COMPRESSORS:

A standard line of single, two-, three- and four-stage compressors for air or any of the commercial gases. Built in any size and for any pressure up to 7500 pounds per square inch. Each Norwalk Compressor is scrupulously tested before it leaves the factory.

Norwalk compressors are approved by engineers for every branch of air or gas compression service. They are in use in every state in the union.

Norwalk machines meet the individual requirements of the purchaser. If you have an unusual problem in air or gas

compression our engineers will coöperate with you. You are invited to make use of our forty years' experience in compressor building.

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Some of the outstanding advantages of Norwalk machines are: uniform air pressure; automatic regulation; high speed, light weight; small floor space; central balanced stresses; inexpensive foundations; complete cooling system; all parts easily accessible; full load, part load or no load as required; intake valves with mechanical movements.

*Bulletins on Air, Oxygen, Hydrogen, Acetylene and Carbonic Acid Gas will be sent upon request.*

## INGERSOLL-RAND COMPANY

11 BROADWAY, NEW YORK

BOSTON, BIRMINGHAM, BUTTE, CHICAGO, CLEVELAND, DENVER, DETROIT, DULUTH, EL PASO, HOUGHTON, JUNEAU, KNOXVILLE, LOS ANGELES, NEW ORLEANS, PHILADELPHIA, PITTSBURGH, ST. LOUIS, SALT LAKE CITY, SAN FRANCISCO, SCRANTON, SEATTLE

### Builders of Pneumatic Machinery

**Air and Gas Compressors-Turbo Blowers-Vacuum Pumps-Air Lift Pumping Systems-Condensers-Pneumatic Riveting and Chipping Hammers, Drills, Wood Boring Machines, Sand Rammers, Hoists, Rock Drilling and Metal and Coal Mining Machinery-Tie Tamping Outfits**

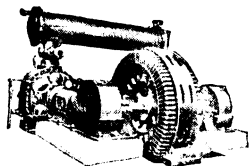
#### Ingersoll-Rand and Imperial Reciprocating Air and Gas Compressors:

High grade, efficient machines of up-to-the-minute design, capable of continuous, high duty service.

"Imperial Fourteen," belt driven, vertical machines range in capacity between 3 and 45 cu. ft. per minute at pressures to 150 lbs. per square inch. Bulletins 3230 and 3131.

572 "Imperial" Type "XB," belt driven, and Type "XPV," piston valve steam engine driven duplex machines are to be had either single or two stage in capacities from 175 to 3500 cu. ft. per minute and for pressures to 500 lbs. per sq. inch. Bulletins 3312 and 3033.

"Ingersoll-Rand" Class "PRE," electric driven and Class "ORC," Corliss engine driven machines are duplex units of large capacity. Bulletins 3126 and 3029.



The Company is also prepared to build compressors to meet special conditions of service.

#### Ingersoll-Rand Turbo Compressors:

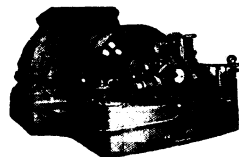
Direct connected steam turbine driven multi-stage centrifugal compressors for handling volumes from 3500 to 10000 cu. ft. per minute at pressures to 100 lbs. per sq. inch.

#### Ingersoll-Rand Turbo Blowers:

Multi-stage centrifugal blowing engines for blast furnaces, copper and lead smelters, Bessemer converters, single-stage blowers for foundry cupolas, oil burners and other low pressure requirements.

Built direct connected to low, mixed or high pressure steam turbine, electric motor or Pelton Wheel.

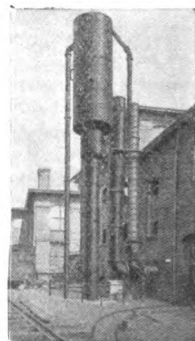
Capacities from 3000 to 60000 cu. ft. per minute at pressures from 1 to 30 lbs. per square inch.



#### Ingersoll-Rand Condensing Equipment:

Counter-current barometric condensers, I-R vacuum pumps and Cameron circulating water pumps. Built to meet all service conditions in turbine and engine work and with vacuum pans, evaporators, dyers, etc.

Can be used continuously with acid or gritty cooling water without necessitating cleaning or repair. Maintain highest vacua with less cooling water. Adapted to use as central condenser serving several units. Bulletin 9124.



## INGERSOLL-RAND COMPANY

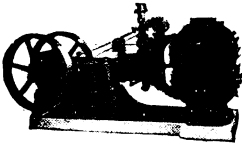
### "Ingersoll-Rand" and "Imperial"

#### Dry Vacuum Pumps:

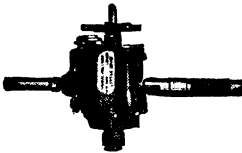
Built for service wherever a highly efficient machine is wanted to maintain vacua up to 26-29.5 ins. mercury (referred to 30" barometer). High speed machines that require less than half the usual floor space.

"Ingersoll-Rand" Class "R," belt driven, and Class "FR" steam driven straight line units range in capacity from 292-2295 cu. ft. per min.—Bulletin 3037.

"Imperial" Type "XB," belt driven, duplex machines are built in capacities from 1048 to 7058 cu. ft. per minute.



#### "Little David" Pneumatic Tools:



Simple, sturdy and efficient tools built in a complete range of types and sizes—a tool for every duty.

Little David Drills—26 sizes.

Little David Wood Borers—3 sizes.

Little David Portable Grinder.

Little David Riveters—5 sizes.

Little David Chippers—7 sizes.

Crown (Bench and Floor) Sand Rammers.

Imperial Air Motor Hoists— $\frac{1}{2}$  to 5 tons.

I-R Drift Bolt Driver.

Little David Calking Machine.

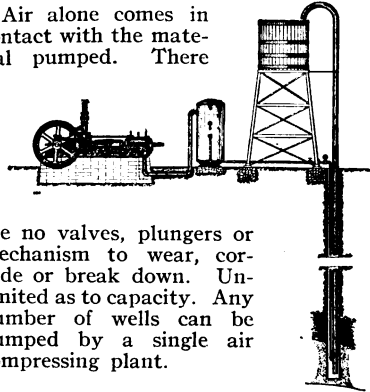
Catalog 8000.



#### Air Lift Pumping Systems:

For pumping deep wells, flowing salt or oil wells, elevating corrosive or gritty fluids, handling acids, pumping marl or pulpy mixtures, handling sewage, unwatering mines, etc.

Air alone comes in contact with the material pumped. There



are no valves, plungers or mechanism to wear, corrode or break down. Unlimited as to capacity. Any number of wells can be pumped by a single air compressing plant.

Catalog 76.

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#### Other Ingersoll-Rand Products:

"Jackhammer" Rock Drills for drilling down holes to 9 feet. Hand held.

"Leyner-Ingersoll" Drills. Mounted type for tunnel driving and mining.

"Stopehamer" Rock Drills for up-hole drilling.

Sergeant Drills for deep hole and sub-aqueous drilling.

"Leyner" Sharpeners for making and resharpening bits, making bolt heads and light forging.

"Calyx" Core Drills for prospecting and testing rock strata and formations underlying earth's surface.

"New Ingersoll" Punching Machines and "Radialaxe" column mounted cutters for coal mining.

"Little Tugger" Hoists for use wherever portable hoisting or hauling power of  $\frac{1}{2}$  ton capacity is reached.

"Imperial" Tie Tampers for compacting railroad ballast of any sort on steam or electric lines.

*Catalogs describing any of the products of the company will be sent you gladly upon request. Address the nearest office.*

## SULLIVAN MACHINERY COMPANY

120 So. MICHIGAN AVE., CHICAGO

BOSTON

PITTSBURGH

30 CHURCH ST., NEW YORK

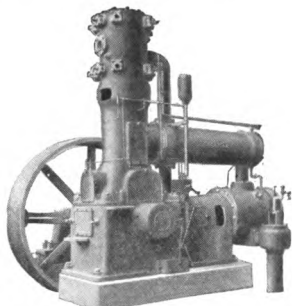
ST. LOUIS

SAN FRANCISCO

Sullivan Air Compressors, Air Lift Pumps, Rock Drills, Channelers, Hammer Drills, Drill Sharpeners, Coal Mining Machines, Quarrying Machinery, Diamond Core Drills, Core Drilling Contracts, Forge Hammers

### AIR COMPRESSORS:

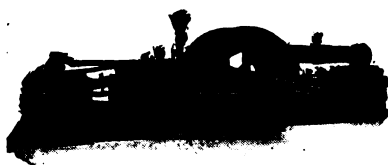
ANGLE-COMPOUND power driven compressors are economical of floor space and secure efficiency through exact balancing of reciprocating parts. For belt or direct connection; single or twin units, 400-2600 cu. ft., equipped with END-ROLLING FINGER VALVES.



Angle Compound, Bulletin 75-CS

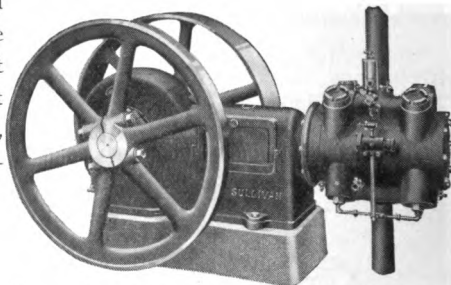
### TANDEM CORLISS UNITS:

Are built in capacities of 1000, 1500, 2000, 2500 and 3150 cu. ft. Full Corliss valve gear on both steam cylinders insures high fuel economy. Two stage air cylinders and a large copper inter-cooler give air end efficiency. The tandem design permits important savings in floor space and foundation.



Tandem Corliss. Bulletin 75-FS

### SINGLE STAGE, STEAM AND BELTED SULLIVAN COMPRESSORS:



Belted, Single Stage. Bulletin 75-GS

Built with all working parts enclosed, the cranks, crosshead, and main bearings being splash-oiled. Improved "Wafer" type inlet and discharge valves are used. Capacity 50-450 cu. ft.

### AIR LIFT PUMPS FOR DEEP WELLS:

Sullivan Air Lift Engineers have studied water supply problems for 25 years. Their advice is free. Ask for details of systems we have installed for towns and factories throughout the country.

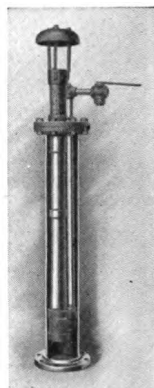
Two types: Outside and central air line. Advantages:

1. **Greatest volume for least power:** The Sullivan Foot Piece contains a perforated tube through which the compressed air is discharged in fine jets, and mixed thoroughly with the water, thus securing maximum lifting effect. A choke or taper above the mixing tube gives velocity to the flow.

2. **No clogging:** A bottom opening permits sand or scale to drop through and leave the perforations clear.

3. **Can't wear out:** Made of heavy bronze, non-rustable.

Sullivan Boosters enable water to be discharged horizontally or at an elevation by reusing the air power employed in pumping.



Bulletin 71-CS



# WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

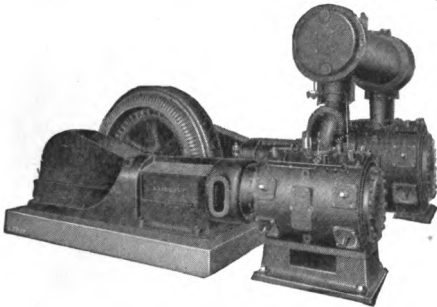
LIDLAW WORKS: Cincinnati, Ohio

Branch Offices in All Principal Cities

**Laidlaw Feather Valve Air Compressors, Vacuum Pumps, High Duty Pumping Engines**

## MOTOR DRIVEN COMPRESSORS:

Laidlaw Feather Valve Power-Driven Compressors are driven by either direct-

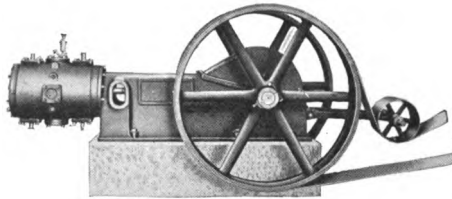


connected engine type motor, or by belt or rope drive. The unique feature of these machines is found in the use of the Laidlaw Feather Valve; efficiency, durability and noiseless operation are thus secured. Laidlaw Power-Driven Compressors are either single-, two-stage or multi-stage. They are built for any working pressure up to 3500 lbs. per sq. in.

are made with full releasing, automatic Corliss steam gear, embodying every refinement and improvement found in the best Corliss power engine. The compressor end is identical with that used on power-driven compressors.

## SMALL LAIDLAW COMPRESSORS:

The same refinement of detail, and the same rugged construction, which characterize the larger Laidlaw Air Compressors are found in the smaller ones. Single-belt and steam-driven compressors are built in capacities ranging from 100

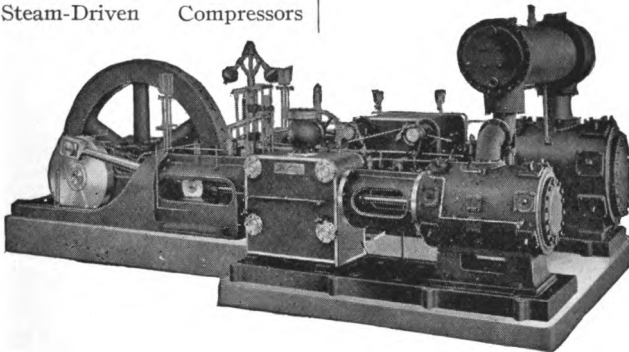


Single-Stage Belt-Driven Feather Valve Compressor

## HEAVY DUTY CORLISS COMPRESSORS:

Where a large capacity is needed, Laidlaw Steam-Driven Compressors

cu. ft. per min. and for pressures ranging from 30 to 100 lbs. per sq. in.



Corliss Feather Valve Compressor

## WESTINGHOUSE TRACTION BRAKE COMPANY

FACTORIES: WILMERDING, PA., AND MILWAUKEE, WIS.

Atlanta, Ga.  
Boston, Mass.  
Chicago, Ill.  
Columbus, O.

Denver, Col.  
Houston, Tex.  
Los Angeles, Cal.

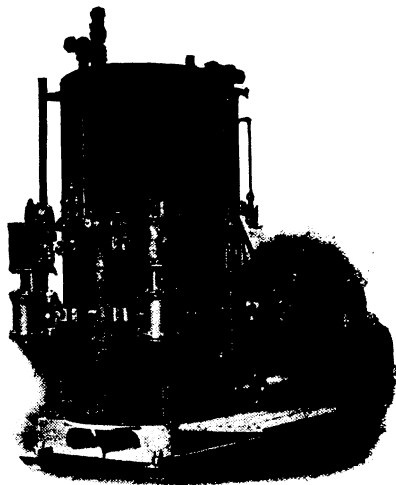
Mexico City  
New York, N. Y.  
Pittsburgh, Pa.

San Francisco  
Seattle, Wash.  
St. Louis, Mo.  
St. Paul, Minn.

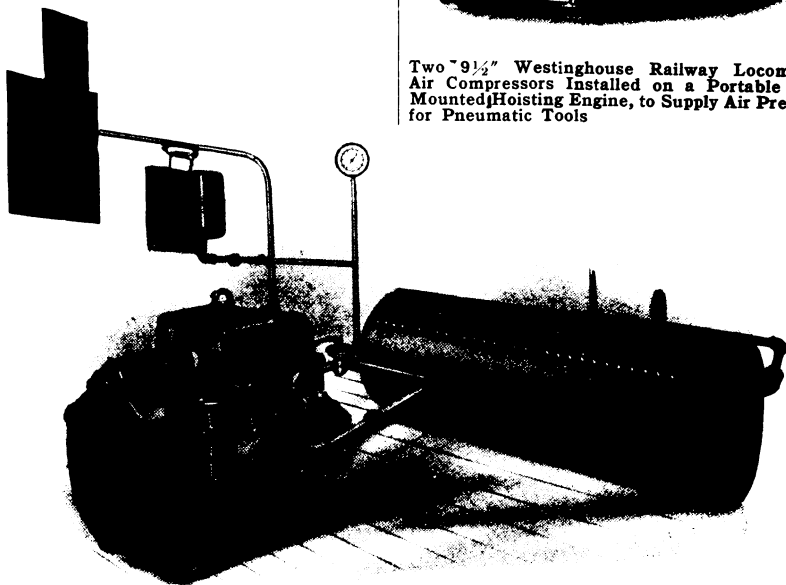
**Manufacturers of Westinghouse and National  
Steam-, Motor- and Belt-Driven Compressors and Accessories**

The Westinghouse 9½" locomotive air compressor is a compact, rugged type of machine, designed for the rigors of railway use. It is especially adapted to rough usage by outside contractors and others requiring a dependable and self-contained machine of this character. Thousands are in industrial service today. See Publication 9012.

Westinghouse motor driven air compressors are compact, self-contained, direct connected, and ideally suited to service in all lines of industrial and commercial plants. Capacities, 4 cu. ft. to 576 550 cu. ft. See Catalogue 9035.



Two 9½" Westinghouse Railway Locomotive Air Compressors Installed on a Portable Skid Mounted Hoisting Engine, to Supply Air Pressure for Pneumatic Tools

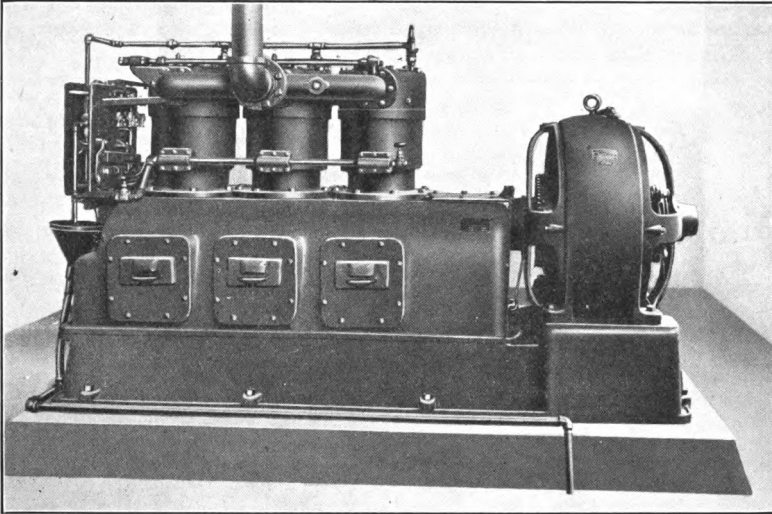


Westinghouse Air Compressor, Type L-3, Water-Jacketed, 220 Volt D. C., 5 H. P. Motor, 26 Cu. Ft. Capacity, Installed in Aeon Garage, New York City, for Pumping Tires. See Catalogue 9035

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## WESTINGHOUSE TRACTION BRAKE COMPANY

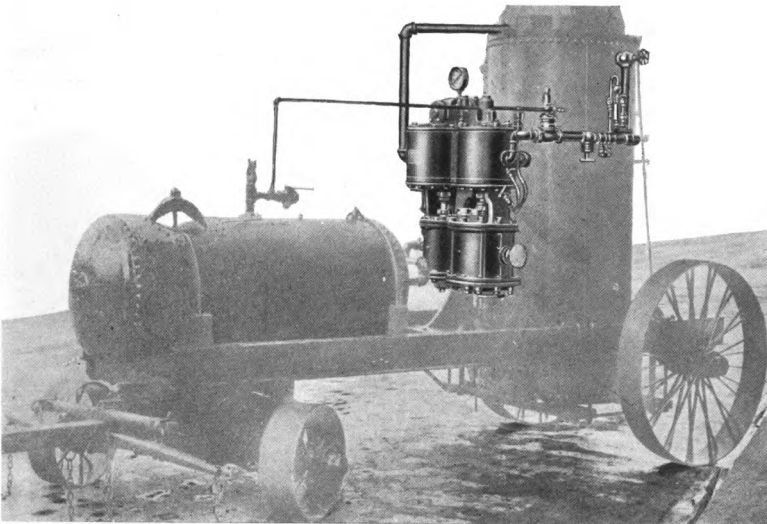
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**Westinghouse-National 3VS-23, Water-Jacketed, Direct Connected, Herring-Bone Gear and Pinion Automatic Control, Installed in Worcester Consolidated Street Railway Shops at Worcester, Mass.**

The Westinghouse-National 3VS type of compressor is especially adapted to general railway shop uses for the operation of all pneumatically operated devices such as pneumatic tools, air hoists, blacksmith forges, paint spraying, etc., is rugged, compact and of neat appearance.

The Westinghouse 10½" Cross 577 Compound locomotive air compressor is exceedingly well suited to rough work of any contractor requiring compactness, reliability of action, low maintenance cost and minimum of attention. See Publication 9012.



**Westinghouse 10½" Cross Compound Locomotive Air Compressor, Mounted on Portable Truck, and Used by New England Contractor for Operating Two Jack Hammers and Three ¾" Tripod Drills**

## AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

**Manufacturers of Heating, Ventilating, Cooling, Purifying, Humidifying, Drying, Mechanical Draft and Blast Equipment; Vertical Self-Oiling Steam Engines, Steam Traps; Fans and Blowers for All Purposes**



### SYSTEM OF PURIFYING, COOLING AND HUMIDIFYING:

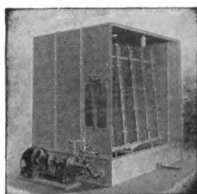


Fig. 1

For Purifying and Humidifying air in Schools, other Public and Semi-Public Buildings.

For Humidifying and Cooling air in Textile Mills, Food and Confectionery Plants, Printing Houses, and other Industrial Plants.

For Dehumidifying and Cooling in Candy Factories, Bakeries, Photo Film Drying Rooms, Blast Furnaces, Electric Generators, etc.

Capacities from 3,500 C. F. M. to 350,000 C. F. M.

578

Write for "detail" information.

Fig. 1 shows "Sirocco" Air Purifier, Cooler and Humidifier.

### MULTI-BLADE FANS AND BLOWERS:

For Heating, Ventilating and Cooling in Public, Office, Industrial and Educational Buildings.

For Drying and Mechanical Draft.

Sirocco Multi-Blade Fans will handle more air consuming less power than the ordinary steel plate fan, having twice the wheel diameter.

Built with capacities of from 75 C. F. M. to 1,000,000 C. F. M.

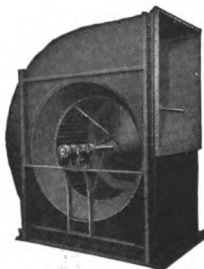


Fig. 2

Complete specifying information at your request.

Fig. 2 shows "Sirocco" Multi-Blade Fan for Pulley, Motor or Engine Drive.

Fig. 3 shows "Sirocco" Multi-Blade Fan Wheel.

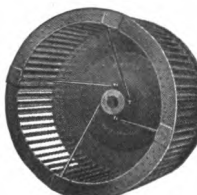


Fig. 3

### "ABC" EXHAUST FANS FOR EXHAUSTING AND CONVEYING SYSTEMS:

Exhaust shavings, dust and refuse from wood-working plants.

Take away the dust from emery grinders, buffing and polishing wheels.

Remove smoke and gases from forge fires.

Exhaust the dust from cement plants, flour mills and similar plants.

Remove steam and vapor from vats and kettles in breweries, packing houses, textile and rubber factories.

Elevate and convey cotton and wool in textile mills.

There is a size and type to meet any requirement.

Capacity tables and complete data sent on request.

Fig. 4 shows Type "E" Fan for pulley drive. This and other types are furnished also with direct connected motors.

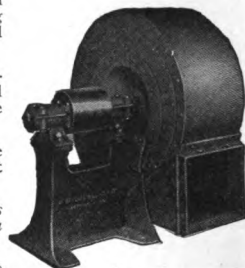


Fig. 4

### TYPE "P" SPECIAL STEEL PRESSURE BLOWERS FOR FURNACE AND CUPOLA SERVICE:

For supplying draft to Oil and Gas Furnaces; Cupolas; Sintering, Smelting and Pulverized Coal Machines.

For blowing scale from dies in drop forge plants.

Bearings being on independent foundations preclude vibration in the housings. Built to discharge at any angle, against pressures from 1 to 24 ounces.



Fig. 5

Ask for complete working data.

Fig. 5 shows Type "P" Special Steel Pressure Blower. Designed for direct connection to electric motor.

## AMERICAN BLOWER COMPANY

### BRANCH OFFICES

ATLANTA, BOSTON, CHARLOTTE, N. C., CHICAGO, CLEVELAND, COLUMBUS, O., DALLAS, DENVER, DES MOINES, EL PASO, TEX., GRAND RAPIDS, MICH., INDIANAPOLIS, KANSAS CITY, LOS ANGELES, MINNEAPOLIS, NEW ORLEANS, LA., NEW YORK, PHILADELPHIA, PITTSBURGH, ROCHESTER, SAN FRANCISCO, SALT LAKE CITY, SEATTLE, ST. LOUIS, with works at DETROIT, MICH., and TROY, N. Y., and CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO



### "ABC" VERTICAL SELF-OILING, STEAM ENGINES:

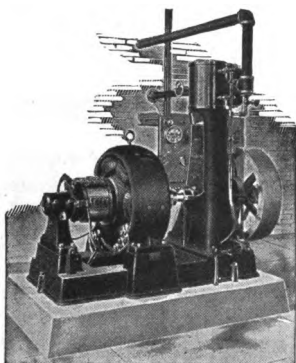


Fig. 6

Type "A"—Single Cylinder—Engines develop up to 60 H. P. For school or other work where steam pressure is limited to 30 pounds—advocate Type "A" Low Pressure Engines, develop up to 40 H. P.

Type "E"—Double Cylinder—Engines develop up to 120 H. P. This engine is advantageous where more than 40 H. P. and fairly high rotative speed are required and only small space available.

Complete information on all types at your request.

Fig. 6 shows "ABC" Engine direct-connected to dynamo for generating electric current.

### "DETROIT" AUTOMATIC STEAM TRAP SYSTEMS:

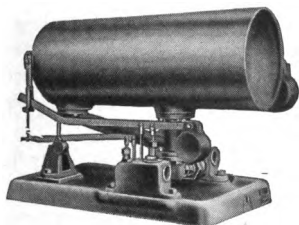


Fig. 7

Return, Non-Return, Vacuum, Metering, Lifting and Combination.

For all steam systems under all pressures.

The hot condensation is returned direct to the boiler automatically—at a temperature nearly equal to that at which it is condensed.

A few applications—Lumber Dry Kilns; Brick Tunnels; Vacuum Pans; Steam Cooking Kettles; Laundry, Veneer and Paper Machines (Heating Systems—Gravity Return—Vacuum); Vulcanizers; Hot Rolls, etc.

Any condensation handling problem can be economically solved by the use of "Detroit" Traps.

Let us send you full data.

Fig. 7 shows "Detroit" Automatic Return Trap.

### TYPE "V" UNIVERSAL BLOWERS AND EXHAUSTERS:

Four angles of discharge right-hand drive and four angles of discharge left-hand drive can be made from one Type "V" Universal Fan (aside from various angular discharges). For all Blowing and Exhausting work requiring up to four ounces pressure.

Built for either pulley or motor drive.

Write for latest Bulletin.

Fig. 8 shows Type "V" Bottom Horizontal Right-Hand Universal Fan. Pulley drive.

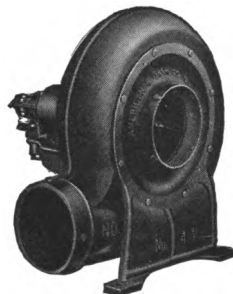


Fig. 8

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### "VENTURA" DISC VENTILATING FAN:

For delivering large volumes of air at low pressure or against small resistances.

Low price—Small power consumption and inexpensive to install.

For ventilating rooms and buildings—Ventura, motor driven, ventilating fans 650 C. F. M. to 17,500 C. F. M.

For ventilating small mines or at any mine where a disc fan can be used—engine or motor driven—from 12,000 C. F. M. to 100,000 C. F. M. resistance not to exceed 1" W. G.

Write for complete information.

Fig. 9 shows Ventura motor driven ventilating fan.

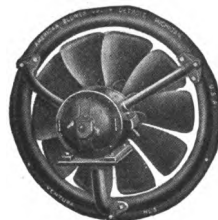


Fig. 9

## NEW YORK BLOWER COMPANY

FACTORIES:  
BUCYRUS, OHIO      LAPORTE, IND.

MAIN OFFICE: CHICAGO, ILL.

BRANCH OFFICES:  
All Principal Cities

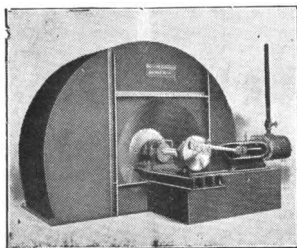
**Sole Manufacturers of Seri-Vane Fans, Blowers, Exhausters, Peerless and Reversible Shaving Fans, Peerless Ventilators and Diffusers, Peerless Air Washers and Humidifiers**

Seri-vane fans, blowers, etc., are made in such a wide variety of sizes and styles that their application is practically unlimited. For each and every engineering problem, we make a particular and distinctive size best suited for results to be obtained, space conditions, etc. While we can supply fans, blowers, air washers, etc., to fill any specifications, we prefer to have our engineering department examine and check all requirements before entering an order. By this careful and strict attention to all orders, we expect to keep up the quality of our product beyond the reach of competitors.

### SERI-VANE FANS AND BLOWERS:

580

It is a well-known and accepted fact that the many blade fans are far superior and efficient to the old type paddle wheel fans. It was only after extended and thorough investigations and tests that we placed our well known **SERI-VANE FANS** on the market. By a scientific construction of not only the fan wheel but the housing also, we have been able to market a product so superior to the others that the results obtained are conceded to be little short of phenomenal.



Our Catalog No. 70 gives a complete description of this type of fans with certain valuable tables and engineering information. All our fans are constructed

throughout of the best material obtainable and size for size are the heaviest fan on the market. We would not cheapen the fan by using lighter material to reduce the selling price.

### PEERLESS AIR WASHERS AND HUMIDIFIERS:

We make the plain air washers as used in the ordinary ventilation system for Schools, Churches, etc., but also the more complex washers, humidifiers and dehumidifiers that are used in so many industries, as the manufacturing of Sausage, Gun Powders, Rubber, Soap, Leather, Textiles, etc.

We can offer valuable suggestions and remedies for each manufacturing problem that may arise. The saving and economy effected is always greater than the first cost.

We make fans, blowers and other allied products for any use where air is handled such as Heating and Ventilation, Forced and Induced Draft, Gas and Forge Blowers, Waste Heat Drying, Shaving and Blow Pipe work, etc.

For each particular subject we have prepared an invaluable treatise which will be sent upon request.

Our Engineering Department is ready at all times to offer suggestions and prepare plans and specifications illustrating fully their solution of any problem at stake.

Please communicate with our nearest office for immediate attention.

### GUARANTEE:

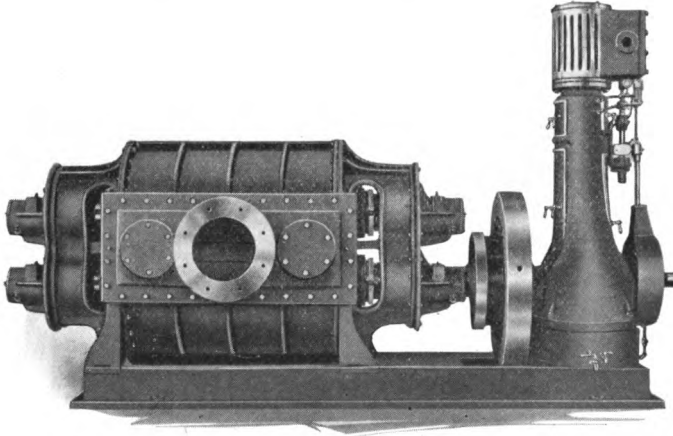
We guarantee the product of our manufacture for five years from date shipped; all claims of any kind and description are cheerfully rectified without any quibbling. The customer must be satisfied.

# WILBRAHAM-GREEN BLOWER CO.

Established 1854

POTTSTOWN, PA.

Sole Manufacturers of Green Patented Rotary Positive Pressure Blowers, Gas Exhausters and Huntoon Patented Gas Governors



No. 7 Gas Exhauster with 7 x 8 Troy Enclosed Vertical Engine

Our Products are known to the trade as

"THE OLD RELIABLE."

## ROTARY POSITIVE PRESSURE BLOWER:

Let us prove to you that if you use the Wilbraham-Green blowers you will be free from care, worry or breakdowns. Made in 18 standard sizes up to 18,000 cu. ft. of free air per minute and up to 5 lbs. pressure. Larger sizes built to order. Send for Bulletin No. 11.

## ROTARY POSITIVE PRESSURE GAS EXHAUSTER:

Modern design and up to the minute on gas engineering requirements. Equipped with ring oil bearings and stuffing boxes that will not leak. Are built in 19 standard sizes up to 17,000 cu. ft. of free air per minute. Larger sizes built to order. Send for Bulletin No. 12.

## ROTARY POSITIVE PRESSURE SMELTER BLOWER:

For smelter work let us give you facts and figures on our present two impeller type smelter blower. Made in 10 standard sizes up to 19,000 cu. ft. of free air per minute and up to 40 oz. pressure. Larger sizes built to order. Send for Bulletin No. 13.

## CYCLOIDAL VACUUM PUMPS:

581

For flat suction boxes. Built for a steady high vacuum and a long life. Made in 11 standard sizes up to 700 cu. ft. of free air per minute. Send for Bulletin No. 15.

## ROTARY POSITIVE PRESSURE BLOWER:

The most modern way to aerate raw water in ice plants, etc. Equipped with belt, reduction gear or noiseless chain drive. Made in 9 standard sizes up to 600 cu. ft. of free air per minute at 3 lbs. Is strong enough for 5 lbs. pressure. Larger sizes built to order. Send for Bulletin No. 16.



Motor Driven Blower

Regular Foundry Blowers both Motor and Pulley Driven a specialty.

Built in all sizes.

*If you desire to deliver air or gas against pressures from 1 to 5 lbs. for any purpose whatever, we believe it will be to your advantage to allow us to quote you.*

## THE ALDRICH PUMP CO.

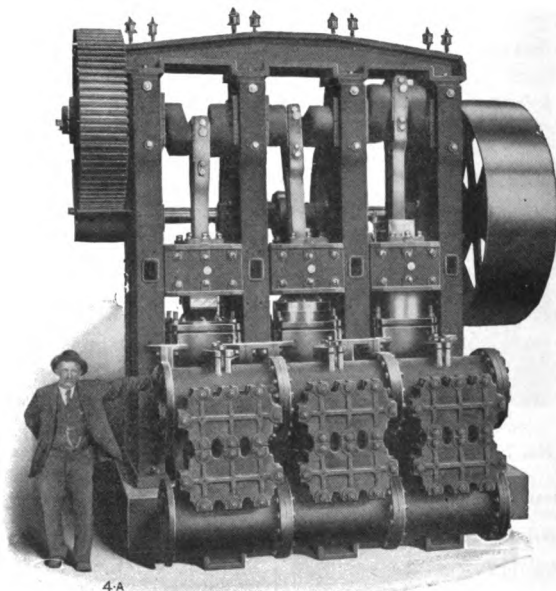
ALLENTOWN, PA.

PITTSBURGH

NEW YORK

CHICAGO

**Manufacturers of Duplex, Triplex and Quintuplex Power Pumps; Hydraulic Machinery**



582

**Fig. 222 Code EDIGH**  
**Single Reduction Geared, Belt Drive**

The machine illustrated above is built to pump 3,500 gallons of water per minute against a maximum lift of 350 feet.

We build pumps for practically any service. These are built in a large range of capacities and for any type of drive desired.

We manufacture pumps to lift or force any fluid, regardless of its consistency, such as sewerage, wood pulp, paper pulp, tar, culm, mash, glucose, sand, concentrates, etc. In fact any slime handled by Centrifugal Pumps, Sand Wheels and Belt Elevators will be handled by our

pumps with the advantages of minimum power consumption, operation against any desired lift and wear reduced to a few inexpensive replaceable parts.

When it is desired to pump acidulous or corrosive liquids the entire water end of our pumps can be lined with cement at small additional expense; below that of a metallic lining and will give as efficient and as satisfactory service.

Tell us what kind of a pump you are in need of and our engineers will be pleased to send you data and recommendations as to the best solution of your problem.



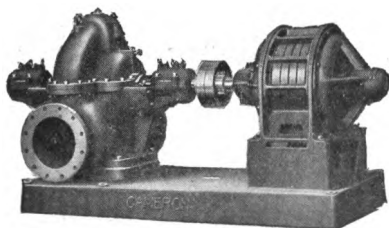
## A. S. CAMERON STEAM PUMP WORKS

11 BROADWAY, NEW YORK

"OFFICES THE WORLD OVER"

Designers and Builders of Centrifugal Pumps; Piston and Plunger Simplex Steam Pumps for all Classes of Service

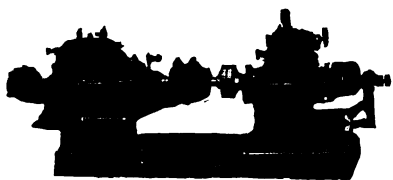
### CAMERON DOUBLE SUCTION VOLUTE PUMP:



Double Suction Volute Pumps (Type DV) are adapted to drive by electric motor, steam turbine or by other forms of power either by direct coupling or belting. DV Pumps are constructed for general service with capacities from 75 to 21000 G. P. M. for heads from 10 to 200 feet. These pumps are of the horizontal, split case type providing instant accessibility to working parts. All parts are manufactured of the best materials, carefully machined and rigidly inspected. All pumps are given a full load running test before leaving the works.

*Bulletin 7150.*

### CAMERON MULTISTAGE TURBINE PUMP:

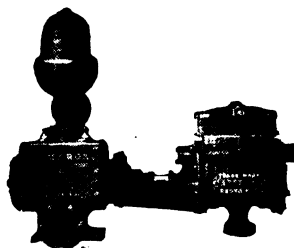


Multistage Turbine Centrifugal Pumps are available up to five stages in a single frame. A greater number of stages can be obtained by installing the pumps in series. Cameron quality and durability is in evidence throughout this entire line.

Kingsbury Thrust bearings or special internal hydraulic balancing devices are utilized to take up thrust. Capacities 75 to 2500 G. P. M. for heads 120 to 1500 feet. Adaptable to steam turbine or other power drive.

*Bulletin 7251.*

### CAMERON REGULAR PATTERN PISTON PUMPS:



583

For general service, when a direct acting pump can be used, the Cameron is unbeatable for rugged construction and long efficient service. Numerous instances are brought to notice of Cameron Direct acting pumps, 50 years in service and "still going strong." Cameron Steam pumps are essentially simple with very few parts and nothing to get out of order.

*Bulletin 7204.*

Cameron Pumps are built to give lasting satisfaction to the user.



# THE DEMING COMPANY

SALEM, OHIO, U. S. A.

NEW YORK OFFICE AND STOCK: 152 Chambers Street

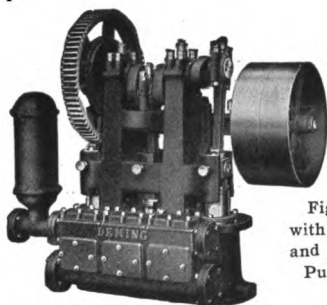
Manufacturers of Hand and Power Pumps for All Uses

## DEMING POWER PUMPS:

DEMING Power Pumps are made in such a variety of styles and sizes that their range of application is practically unlimited where belts, water wheels, electric motors, or steam, gas or gasoline engines are available sources of power. The types include Single- and Double-Acting Triplex Pumps for various services, Deep Well Power Working Heads, Artesian Well Cylinders, Rotary and Centrifugal Pumps. They are all built upon such lines as to insure great durability, efficiency, reliability, ease of operation and low cost of maintenance.

### Deming Single-Acting Triplex Plunger Pump:

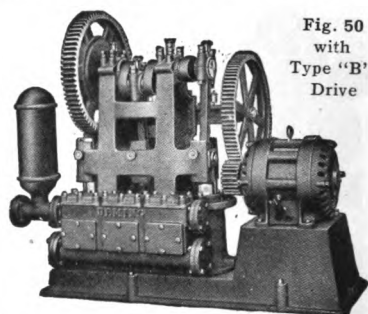
584



Size 7x8 to 8½x8

Fig. 50 (illustrated), Single-Acting Triplex Pump, is designed for water works, hydraulic elevator service, boiler feed, pulp grinders and general water supply.

Deming Triplex Pumps embody the principle of the three-throw crankshaft, with the crank pins at an angle of 120 degrees with each other, by which ar-



Size 5½x8

range the strokes follow and overlap one another. This results in a continuous and uniform action upon the fluid being pumped, and insures an easy flow through the delivery pipe, with a corresponding high degree of efficiency in the operation of the pump.

All of our triplex pumps, whether of low service, medium or heavy pressure types, have the plungers with crossheads outside guided, thereby relieving the stuffing-box glands of lateral pressure due to the side thrust of the connecting rods.

*Individual Bulletins of Deming Power Pumps Will Be Mailed to Engineers on Application.*

FIG. 50, STANDARD SIZES, CAPACITIES, ETC.

PLUNGERS				DIAM. OF PIPES		PLUNGERS				DIAM. OF PIPES	
Diam. In.	Stroke In.	CAPACITY Gallons Per Hr.	Max. Working Pressure, Lbs.	Suction In.	Discharge In.	Diam. In.	Stroke In.	CAPACITY Gallons Per Hr.	Max. Working Pressure, Lbs.	Suction In.	Discharge In.
2	2	340	150	1½	1	6	8	9660	140	4	3
2½	2½	532	150	1½	1	7	8	13400	150	5	4
2½	3	684	150	2	1½	8	8	17240	150	5	4
3	3	972	150	2	1½	8½	8	19460	140	6	5
3½	3	1320	150	2½	1½	9	10	24800	160	8	6
3½	4	1800	150	2½	2	10	10	27600	150	8	6
4	4	2340	150	2½	2	11	12	37400	160	10	8
4	6	3540	160	2½	2	12	12	44400	150	10	8
4½	6	4440	150	3	2½	12	14	49200	150	12	10
5	6	5460	150	3	2½	13	14	58000	140	12	10
5½	8	8840	150	4	3						

## **EPPING-CARPENTER PUMP CO.**

MAIN OFFICE AND FACTORY

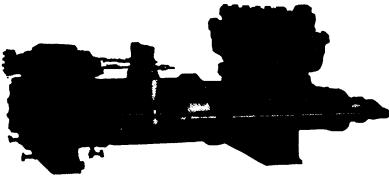
PITTSBURGH, PA., U. S. A.

Sales Offices or Agencies in all Principal Cities

**Manufacturers of Pumping Machinery and Condensers**

**EPPING-CARPENTER** manufactures direct-acting pumps fitted with simple, compound, and triple expansion steam ends.

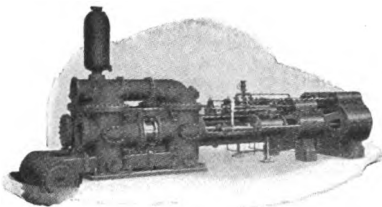
Simple, Compound, and Triple Steam Ends can be equipped with our balanced piston valve and adjustable valve gear, if specified.



Cut No. 622  
Outside End Packed, Pot Type Pump

### **WATER ENDS:**

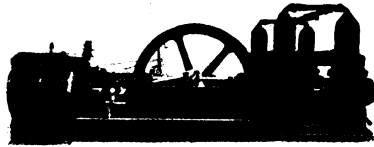
Our Pumps are fitted with Outside End Packed, Pot Type Water Ends, as illustrated by Cut 622, also Outside Center Packed Plunger type, and Piston Packed Type Water ends.



Cut No. 600  
Triple Expansion Center Packed Pump

### **FOR WATER WORKS SERVICE:**

We manufacture Triple Expansion Pumping Engines, as illustrated by Cut 600, Corliss Cross Compound Pumping Engines, as shown on Cut 727, and Meyer Gear Pumping Engines.



Cut No. 727  
Corliss Cross Compound Pumping Engines

### **FOR HYDRAULIC SERVICE:**

We offer High Efficiency Power Pumps, equipped with Herringbone Gears, and fitted with water ends as illustrated in Cut 766.



Cut No. 766  
High Efficiency Power Pump

585

### **CENTRIFUGAL PUMPS:**

We manufacture Volute and Multi-Stage Centrifugal Pumps, either for belt, motor or steam turbine drive.

### **FOR OIL LINE PUMPS:**

We offer Triple Expansion, Corliss and Power Pump types, complete in every detail, which have given exceptional service.

Pumping machinery for every service, designed for hard usage, simple and economical operation and long life.

**FIFTY-THREE YEARS IN BUSINESS.**

# THE GOULDS MANUFACTURING COMPANY

MAIN OFFICE AND WORKS

SENECA FALLS, NEW YORK

NEW YORK  
16 Murray St.  
PHILADELPHIA  
111 North 3rd St.

BOSTON  
58 Pearl St.  
PITTSBURGH  
Oliver Bldg.

CHICAGO  
12-14 S. Clinton St.  
ATLANTA  
3rd Nat'l Bank Bldg.

HOUSTON  
1001 Carter Bldg.  
CLEVELAND  
2179 E 18th St.

Manufacturer of Pumps for Every Service

## GOULDS PUMPS:

The Goulds Line includes hand and power pumps for every service. For 71 years Goulds Reliable Pumps have been generally recognized as the world's standard of quality. They are built to operate with the least possible power and all parts are made of the best material to give long, reliable service. They are rated conservatively, and when you get a Goulds Pump you can be absolutely sure that it will do just what we claim for it. Every Goulds Pump sold is guaranteed to give reliable, satisfactory service under the conditions for which it is recommended.

586

We have distributing houses and representatives in all principal cities, where stocks of pumps are carried from which prompt shipment can be made.

## SERVICE:

The Goulds line includes types and capacities for all pumping services from water to tar and clay, and either acid, alkali or neutral.

It includes the small pump as well as the large pump delivering thousands of gallons per minute.

The Pumps can be furnished for belt, chain, gear or direct drive from all types of drivers.

## ENGINEERING SERVICE:

Parties contemplating the installation of pumping equipment are invited to present their problems to this organization, which is prepared to assist in selecting the proper and most economical pump for their purposes.

Here follow a few points descriptive of a few of the pumps we make.

## CENTRIFUGAL PUMPS:

Single Stage, Single Suction (Fig. 3000-3004)

The Fig. 3000 Single Stage, Centrifugal

Pump, although extremely well adapted for general pumping service, is also well fitted for many special services. There are no valves to get out of order, and the pump is practically noiseless in operation.

The large open water passages of the Goulds Single Stage, Single Suction Centrifugal Pump adapt it particularly well for handling sewage and similar liquids. As a mine pump, it is well fitted, since the sand and grit, nearly always present in mine water, will not injure it. As a pump for irrigation, general water supply and booster service, Goulds Centrifugal Pumps excel on account of the high efficiencies which are obtained.

Figure 3004 illustrates the Goulds Single Stage, Single Side Suction Horizontal

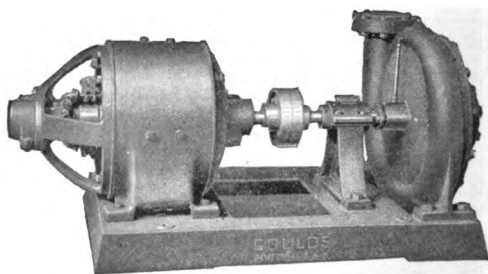
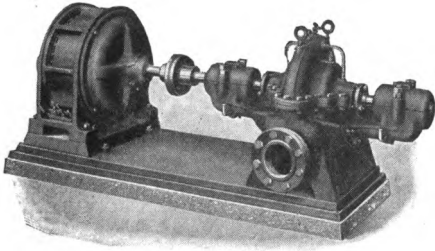


Figure 3004 Connected to Electric Motor

Shaft, Centrifugal Pump direct connected to an electric motor. The pump and the motor are mounted upon an extended cast iron base plate, making the unit practically self-contained. The pump and the motor are direct connected by means of a suitable coupling of the flexible or rigid type, depending upon the conditions of service. It is built in sizes that range from 30 to 4200 gallons per minute capacity. Built in either right or left hand style.

## THE GOULDS MANUFACTURING COMPANY

### SINGLE STAGE, DOUBLE SUCTION: (Fig. 3030)



Goulds Fig. 3030 Double Suction Centrifugal Pump

Figure 3030—Single Stage, Double Suction Centrifugal Pump, direct connected to an open type motor. This unit is adapted for general water supply.

For general water supply, hot water circulating in heating systems, for irrigating, booster or mine service, where the total net head does not exceed 150 feet, the Goulds Single Stage, Double Suction Centrifugal Pump excels on account of the high efficiency obtained. 80 to 8000 gallons per minute, based on cold clear water 150 ft. head or 65 lb. pressure.

### CENTRIFUGAL SUMP PUMPS: (Fig. 3013)

The Goulds Fig. 3013 Electric Sump or Bilge Pump is designed to meet the demand for an automatic electric pump to elevate to street sewers the drainage in buildings where the basement floors, boilers and elevator pits are below sewer level or for any other service where the liquid to be pumped accumulates in a catch basin, pit or tank.

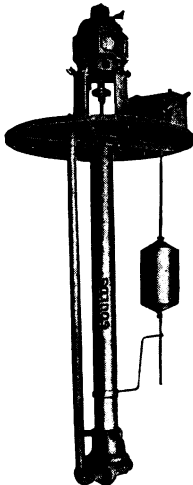


Fig. 3013 Centrifugal Sump Pump

### CENTRIFUGAL FIRE PUMPS: (Fig. 3014)

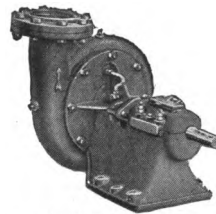
The Goulds Centrifugal Pump has all of the characteristics that are the most desirable for fire protection service. The capacity is large for the floor space required, and the weight and first cost are low as compared with many other types of pumps; the construction is extremely simple and there is nothing to get out of order and cause delay when the pump is needed; the pump is adapted for direct connection to electric motors or steam turbines; and it maintains a steady pressure at the discharge.

Capacities from 500-1500 gallons per minute at 150 lb. pressure.

### SINGLE STAGE, SINGLE SUCTION, ENCLOSED IMPELLER: (Fig. 3025)

Goulds Fig. 3025 Horizontal Single Stage, Single Suction Enclosed Impeller Centrifugal Pump has been developed to meet the demand for high efficiency in a moderately priced machine.

It is a higher speed line than the Fig. 3000 and 3004, and is designed especially for direct connection to electric motors. The range of capacity and head can be accommodated at motor speeds readily obtainable in direct current, and alternating current of twenty-five, fifty and sixty cycles frequency. All main bearings are of the ring oiling type, sizes 5 and 6 having two rings. It will be noticed that the pump consists of but very few parts, and it has the utmost simplicity of design. In addition to cold water these pumps may be used for pumping clear liquids such as brine, cold beer, gasoline, kerosene, light machine oils, etc.



Goulds Fig. 3025 Centrifugal

587

(Continued on next pages)

(Continued from preceding pages)

## THE GOULDS MANUFACTURING COMPANY

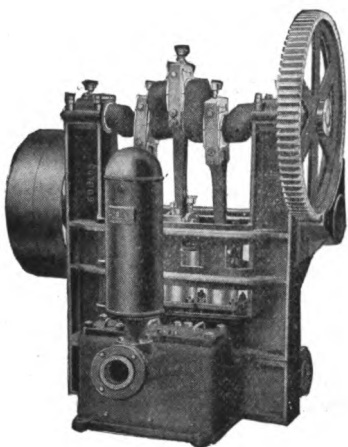


Fig. 1696

### TRIPLEX PLUNGER PUMPS:

588

These pumps are designed on the same general lines throughout, but details of construction are varied somewhat for different working conditions and pressures, the latter ranging from 100 lbs. or 231 ft. elevation to 300 lbs. or 639 ft. elevation.

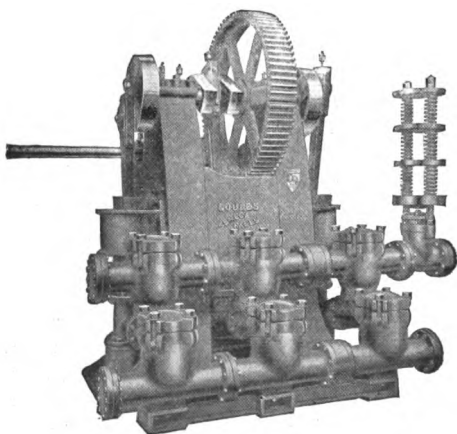


Fig. 1585

Figure 1585 is built in sizes covering a wide range of service, including general water supply, municipal waterworks, boiler feeding, hydraulic elevators, mine pumping, oil pipe lines, accumulators, hydraulic presses, etc. For 215 to 1,500

Pounds Working Pressure or 500 to 3,500 Feet Elevation.

### DEEP WELL TYPE:

For 130 Pounds Working Pressure or 300 Feet Elevation. Capacities ranging from 5,400 gallons to 16,500 gallons per hour. For deep open wells, where the water is too low to be reached by suction from the surface.

### PORTABLE MINE TYPE: (Fig. 966)

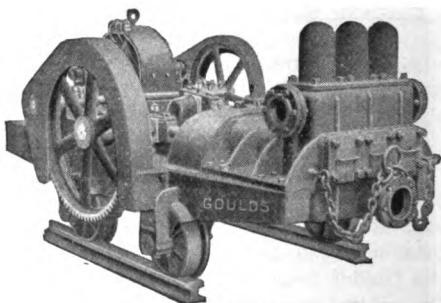


Fig. 966

This pump is of the horizontal, outside packed plunger type, and is designed especially for pumping mine sumps. It is made for any gauge of track, compactly and strongly built to take up as small a space as possible, consistent with good service. Three air chambers are used instead of one to reduce the height. Any make of moisture-proof motor can be fitted to this pump. For 130 Pounds Working Pressure or 300 Feet Elevation.

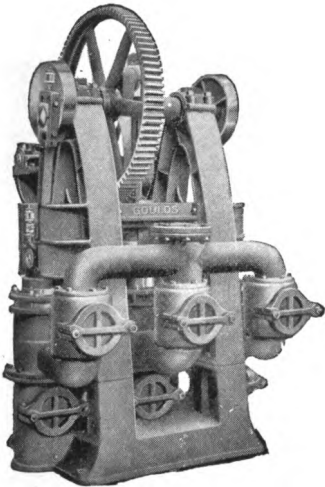
### DOUBLE ACTING PISTON VACUUM PUMPS:

Vertical, Horizontal, and Horizontal Duplex types. These pumps are designed for Suction-Box on Paper Machines, Vacuum Pans, Surface Condensers, and Vacuum system of Steam Heating. They have a displacement of 10,200 gallons to 162,000 (Duplex type) per hour. A special feature of the construction of the Horizontal types is that the waterways are so constructed that the valves at both ends of the cylinder are always submerged and the usual priming of the valves is not necessary.

# THE GOULDS MANUFACTURING COMPANY

## **SINGLE-ACTING TRIPLEX PLUNGER STUFF PUMPS:**

For 65 and 43 Pounds Working Pressure or 100 to 150 Feet Elevation. Manufactured in three types, Nos. 1128, 1105 and 969 series with capacities ranging upward to 56 tons dry paper in 24 hours with Pumps 1128. Designed and built to stand constant hard work, pumping Wood Pulp and Stuff in Paper Mills and Pumping Size in Textile Mills.



**Fig. 1128**

## **BULLETINS:**

The following bulletins, any of which will be sent on request, give complete specifications on the various standard types of Goult's Power Pumps.

No. 100 Double-Acting, Single-Cylinder Piston Pumps.

No. 101 Single-Acting, Triplex Plunger Pumps, Outside - Guided Type.

No. 103 Single-Acting, Triplex Plunger Pumps, Large Capacity and High Pressure Types.

No. 104 Double-Acting, Triplex Piston Pumps, Vertical Type.

No. 105 Single-Stage, Single Side Suction Centrifugal Pumps.

No. 106 Vacuum and Stuff Pumps.

No. 107 Deep Well Triplex Pumps.

No. 108 Deep Well Working Heads and Cylinders.

No. 109 Portable Mine Pumps.

No. 110 Single-Stage, Double-Suction Centrifugal Pumps.

No. 111 Centrifugal Sump Pumps.

No. 112 Handy Data on Power Pumping.

No. 113, Power Rotary Pumps.

No. 114 Vertical Single-Stage Centrifugal Pumps.

No. 115 Double-Acting, Triplex Plunger Pumps, Horizontal Type.

No. 116 Single-Acting, Triplex Pressure Pumps.

No. 117 Air Pressure and Vacuum Pumps.

No. 118 Centrifugal Fire Pumps.

No. 119 Single Stage, Single Suction Centrifugal Pumps, Enclosed Impeller Type.

No. 120 Multi-Stage Centrifugal Pumps for General Service.

Every Goult's pump is guaranteed to satisfactorily perform the specific work for which we recommend it.



## THE JOHN H. MCGOWAN COMPANY

CINCINNATI, OHIO

Steam and Power Driven Duplex Pumps for All Uses

### PRODUCTS:

Duplex Steam and Power Driven Pumps for all uses; Deep Well Power Heads; Elevator and Water Works Pumping Engines; Electric Pumps furnished with all customary forms of drives in Mounted Motor and Extension Base Types.



TRADE MARK

The valve plate design of duplex steam pump is built in the packed piston and outside center packed plunger patterns in all commercial sizes having fluid ends  $8\frac{1}{2}'' \times 12''$  and smaller. They represent a high standard of pump construction, which insures a decided reduction in the cost of maintenance and improvement in pump service.

### SPECIFICATIONS:

Complete specifications covering detailed construction will be furnished with all proposals for special equipment and for standard steam and power driven pumps when requested.

### INSTALLATION DIAGRAMS:

All bulletins relating to McGowan duplex steam or power driven pumps have the installation diagrams incorporated for the convenience of the buyer in planning their location.

### DUPLICATE PARTS:

Except with regard to the final fitting necessary in the installation of large duplicate parts of pumping units, because of the variations in castings due to usual foundry practice, all McGowan duplex pumps are built on the interchangeable system, through the use of modern jigs and templates.

### INSPECTION:

The resumption of production on McGowan duplex steam and power driven pumps following the completion of war work, will be under the same rules of inspection inaugurated by the U. S. Shipping Board, Emergency Fleet Corporation in the production of pumps for the Emergency Fleet.

### MCGOWAN DUPLEX STEAM PUMPS:

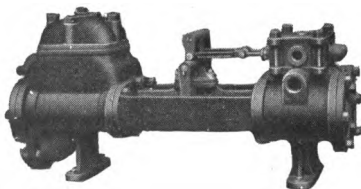


Fig. 295  
McGowan Duplex Steam Pump

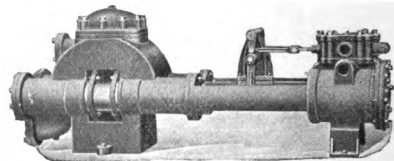


Fig. 331  
McGowan Duplex Steam Pump

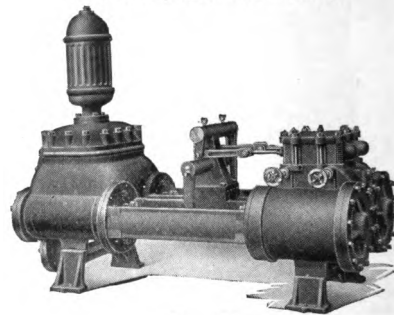


Fig. 439  
McGowan Duplex Steam Pump

**Bulletins**—61 relates to packed piston boiler feed and general service pumps.

62 relates to packed piston tank or low service pumps.

63 relates to outside center packed boiler feed or general service pumps.

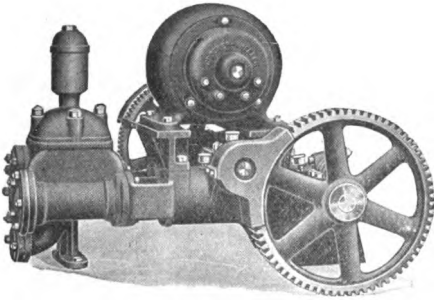
64 relates to packed piston automatic feed pumps and receivers.

### MCGOWAN DUPLEX POWER PUMPS:

The valve plate design of duplex power pump is built in the packed piston and outside center packed plunger patterns. The sizes correspond to the pump ends used in the McGowan duplex steam pumps of the same design and are interchangeable with them. They represent a line of commercial duplex power pumps adapted for all modern types of drives.



## JOHN H. McGOWAN COMPANY



**Fig. 374**  
**McGowan Duplex Power Pump**

**Bulletins**—81 relates to packed piston general service pumps.

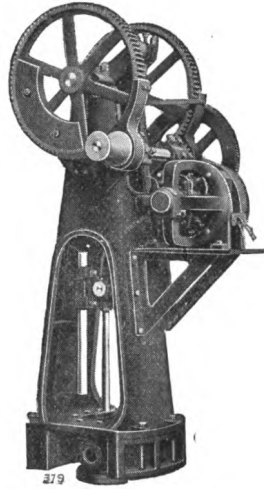
82 relates to packed piston tank or low service pumps.

83 relates to outside center packed general service pumps.

84 relates to packed piston automatic feed pumps and receivers.

### **McGOWAN DEEP WELL POWER HEADS:**

For service in connection with single or double acting working barrels for tubular wells, or for service in connection with independent pump cylinders in open wells; adapted for the use of either the plunger rod or the displacement plunger. The former is used invariably in connection with double acting working barrels, and frequently in connection with single acting working barrels for surface discharge; the latter is used only in connection with single acting barrels, the size of the dis-



**Fig. 379**  
**McGowan Deep Well Power Head**

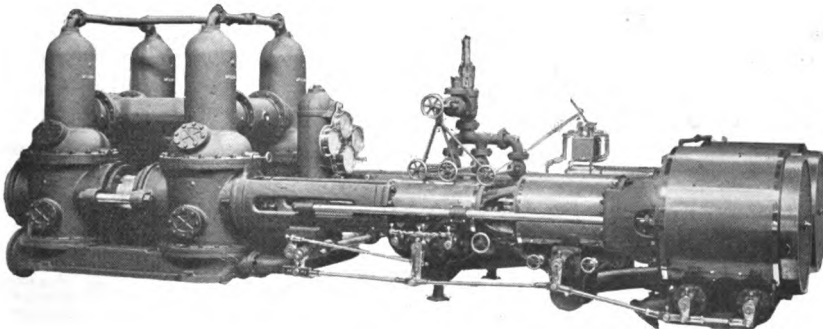
placement plunger being governed by the size of the working barrel used.

591

**Bulletin**—41 relates to deep well power heads.

### **McGOWAN DUPLEX SPECIAL SERVICE PUMPS:**

Built in either packed piston, inside packed, outside center packed or ram patterns for all usual duties, in simple, compound and triple expansion types. The water works pumping engines are built in all capacities up to 5,000,000 gallons per day. Specifications and proposals furnished to conform to specified conditions.



**Fig. 431—McGowan Duplex Special Service Pumps**

## MORRIS MACHINE WORKS

BALDWINVILLE, N. Y.

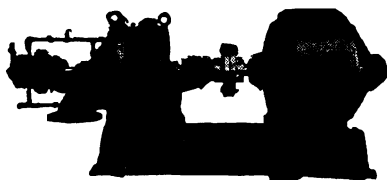
Branch Offices in Principal Cities

**Builders of Centrifugal Pumping Machinery, Hydraulic Dredges, Stationary and Marine Engines**

We build CENTRIFUGAL PUMPS for almost any service and of all types including side suction and double suction, vertical or horizontal shaft. STAGE PUMPS for high heads. TWIN PUMPS for large capacities and high speeds. Or will design SPECIAL PUMPS to suit special conditions. As the oldest and largest firm in the country building exclusively this class of machinery, our experience of over fifty years has covered all services for which Centrifugal Pumps have been used.

### MORRIS CENTRIFUGAL PUMPS:

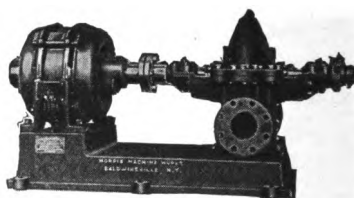
592 Are perfectly balanced, require small space and foundation; have high efficiency; are equally suitable for from small up to very large capacities, and can handle sand or solids with the water without injury. These pumps direct connected to reciprocating engines are suitable for moderate heads, or direct connected to electric motor or steam turbine (or belt driven) for high heads. For heads above 100 feet, pumps are preferably built in stages.



Horizontally Split Multi-Stage Pump

The SINGLE- and MULTI-STAGE horizontally split pumps, illustrated, are built to meet the demand for a pump capable of high speed and efficiency. We build them from 2" up to 20" discharge. They are bronze fitted and where pump-

ing acids the entire water end is made of acid-resisting bronze. This type is used by the Navy Department, arranged for belt, motor or turbine drive as desired.



Horizontally Split Single-Stage Pump

### DREDGING PUMPS:

MORRIS DREDGING PUMPS are made in sizes from 2" discharge and upward, built of cast iron, carbon or manganese steel, both lined and unlined. They are belt driven or direct connected to steam engines. For the sake of economy 15-inch and larger dredging Pumps are usually directly connected to compound or triple expansion steam engines. We have also many dredging pumps in service directly connected to electric motors. We can furnish pumps only or the complete dredge, including all machinery.

### STEAM ENGINES:

We also build a complete line of STATIONARY and MARINE ENGINES, in single cylinder, compound and triple expansion types from 1½ up to 1000 H. P.

*Write for complete  
catalog today.*



## MORRIS MACHINE WORKS

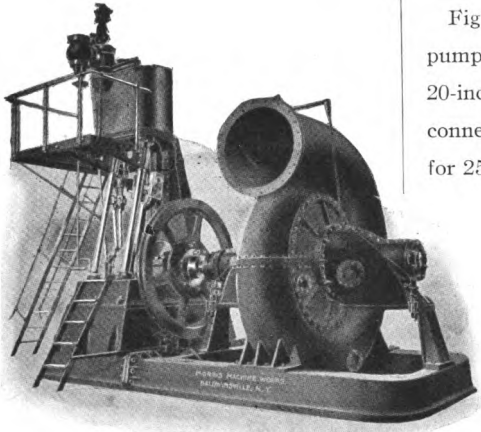


Fig. 1

Fig. 2 shows a set of large circulating pumps for surface condensers. They are 20-inch All Composition Pumps, directly connected to Compound Engines. Built for 250 pounds steam pressure.

Fig. 3 shows a large triple expansion marine engine of 800 H. P.

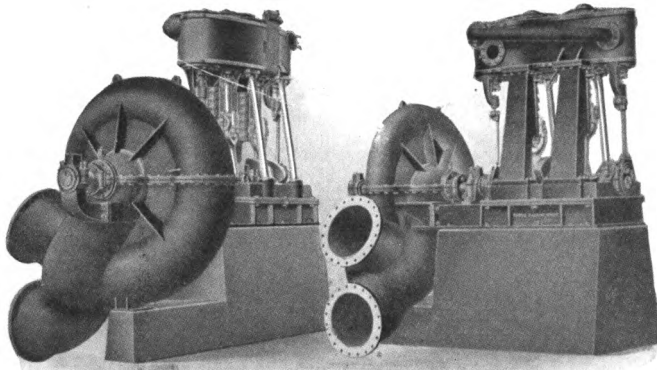


Fig. 2

At present we are making a specialty of circulating pumps for surface condensers, marine engines, as well as dry dock pumps.

Fig. 1 shows one unit of a large dry dock pumping system, which consists of three 36-inch directly connected Pumping Engines. Total average capacity, 115,000 gallons per minute. Total horsepower engines, 1050.

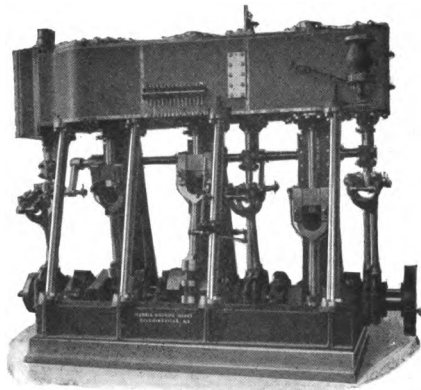


Fig. 3

## PLATT IRON WORKS

GENERAL OFFICES: DAYTON, OHIO

Branch Offices in Principal Cities

**"Platt" Double Suction Single- and Multi-Stage Centrifugal Pumps; "Smith-Vaile" Steam and Power Pumps; "Stilwell" Feed Water Heaters; "Smith-Vaile" Oil Mill Machinery**

### PLATT DOUBLE SUCTION CENTRIFUGAL PUMPS:

#### Single-Stage

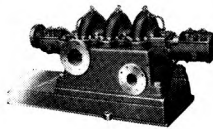
These pumps are built in sizes from 1½" to 50" discharge, for all classes of service where centrifugal pumps can be used. Their rugged construction guarantees efficient and continuous service. Double suction impellers and volute casings are used.



### 594 PLATT DOUBLE SUCTION CENTRIFUGAL PUMPS:

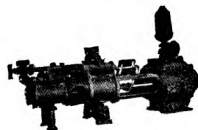
#### Multi-Stage

Double suction impeller is used in each stage and thus all end thrust is eliminated. This is a very reliable and satisfactory pump for high head pumping conditions, boiler feed service, municipal water works, and mine drainage work.



### SMITH-VAILE STEAM PUMPS:

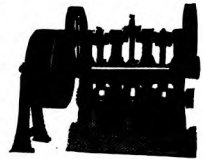
We build a complete line of direct acting steam pumps for a full range of capacities, pressures, and for handling various liquids. The details of these pumps are the result of over fifty years as builders of pumping machinery.



Catalogs, Bulletins, Drawings and complete data covering our lines sent promptly on request.

### SMITH-VAILE POWER PUMPS:

These pumps are built in very rugged construction and can be arranged for belt drive, chain drive, or direct geared to motor. The line covers the complete range of capacities and pressures. These pumps are giving satisfactory service wherever installed.



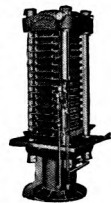
### STILWELL FEED WATER HEATERS:

We build the Stilwell Cast Iron Open Type Feed Water Heaters in sizes from 50 boiler H. P. to 16,000 boiler H. P. They are equipped with float controlled cold water inlet valves, double filtration system, and efficient oil separator. The overflow can be arranged with water seal or float controlled trap.



### SMITH-VAILE OIL MILL MACHINERY: Press Room Equipment

Smith-Vaile press room equipment has been for years the standard in the cottonseed oil industry. Cookers, Steam and Hydraulic Cake Formers, automatic change valves, hydraulic pumps, accumulators, presses and crusher rolls are built by us for this special work.



Let us know your pumping requirements and we will be glad to specify the size and type of pump best suited for your particular work. Trained engineers are maintained in our organization for this particular work.

# THE PRESCOTT COMPANY

MENOMINEE, MICHIGAN, U. S. A.

MINE

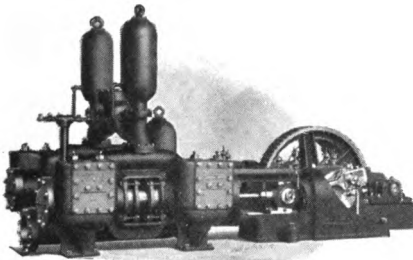


PUMPS

## Electric Drive

The past five years have been, perhaps, as historical a time in the development of pumping machinery for mines as any so far in the life of this great industry, and the two outstanding reasons for this are: First, the ever-increasing use and adaptation of electricity in the mining fields; and, secondly, the greater depths to which shafts are being sunk.

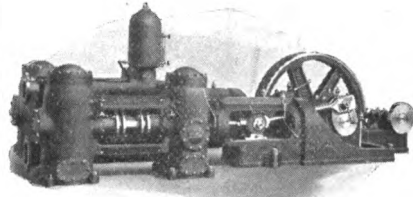
Type "C"



Built in Sizes up to 1000 G. P. M.  
and 500 ft. Hds.

In the ordinary wet mine a greater variety of problems to pump builders is found than in any other place. Mining men have every condition to contend with known to pump manufacturers. All kinds of pumps are used, the entire field of low and high service is covered—water of every character is encountered and it is an extremely serious proposition in the case of the average mine to keep the pumps running continuously. It is a hard service and the best pumps money can buy are absolutely necessary.

Type "M"



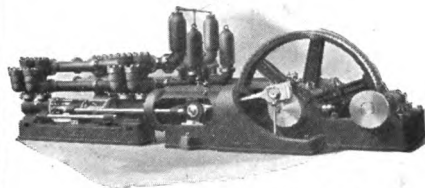
Built in Sizes up to 5000 G. P. M.  
and 500 ft. Hds.

We design and build just such Electric Mine Pumps. They are of the horizontal duplex double acting type and are made in sizes for any capacity and any pressures. Large valve areas and water passages characterize all our different types. Friction losses are thus reduced to a minimum and pumps of the highest efficiency obtained.

595

The steady growth of our business and rapid extension of our lines render it impossible to show everything here that we make. The machines illustrated, however, will give those contemplating buying pumping machinery a fair idea of the nature of our product.

"Pot Form"



For Any Gallonage and Any Head

We would, therefore, appreciate it highly if prospective purchasers would write us relative to their individual problems and the purpose to be accomplished, and allow us to submit detailed information covering their requirements.

## WARREN STEAM PUMP COMPANY

WARREN, MASS.

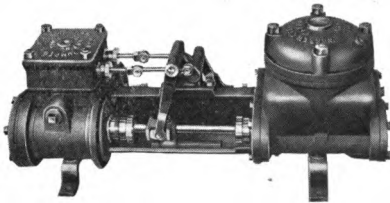
Manufacturers of Steam and Power Pumping Machinery

### WARREN PUMPING MACHINERY:

Warren Steam and Power Pumps are made in a variety of types and sizes, for almost every purpose to which pumping machinery can be adapted. The same high standard adopted by this company at its inception for the manufacturing of its product, has been rigidly maintained and to-day the Warren Standard is recognized as typifying the best in design, materials and workmanship.

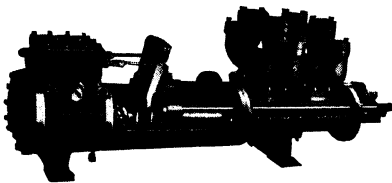
### WARREN DUPLEX PUMPS:

596



Size  $5\frac{1}{4} \times 3\frac{1}{2} \times 5$ , Piston Pattern

Made in many different styles and sizes from 3" x 2" x 3" upward, with both simple and compound steam cylinders, and separate and solid water cylinders.

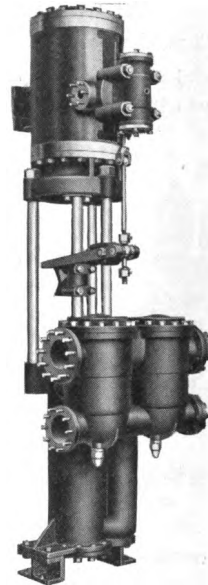


Size  $10 \times 6 \times 12$ , Plunger Pattern

Made in both solid barrel and valve pot types, in a variety of sizes, for medium and heavy pressures.

### WARREN VERTICAL SINGLE FEED PUMPS:

Warren pumps of this type are made in a variety of sizes, with strokes of different lengths up to 24". The long stroke type, though designed to meet the severe requirements of Marine service, has been gradually adopted by discriminating engineers, particularly for



Size  $16 \times 12 \times 24$ , Valve Pot Type

installations where limited floor space or economy in steam consumption is a dominant factor.

In addition to many other types of pumps, we build Jet Condensers and Receiver Outfits for high and low pressures.

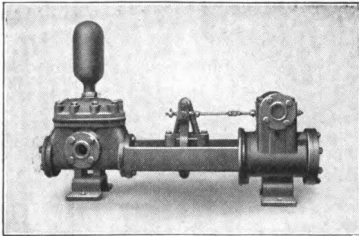
*Blue Prints and Estimates Furnished.*

# WORTHINGTON PUMP AND MACHINERY CORPORATION

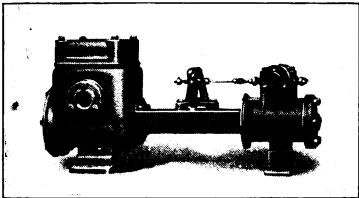
MAIN OFFICE: 115 BROADWAY, NEW YORK

BLAKE-KNOWLES WORKS: EAST CAMBRIDGE, MASS. Branch Offices in All Principal Cities

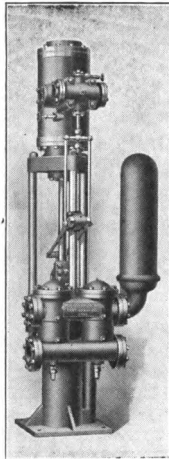
Simplex Pumps, Vacuum Pumps, Underwriter Fire Pumps, Boiler Feed Pumps



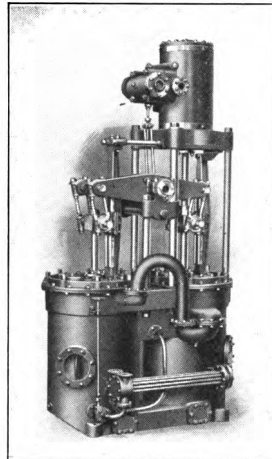
Style "A" Boiler Feed Pump



Steam Heating Vacuum Pump

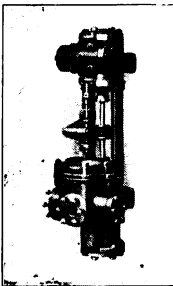


Vertical Boiler Feed Pump

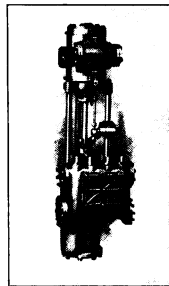


Twinplex Vacuum Pump

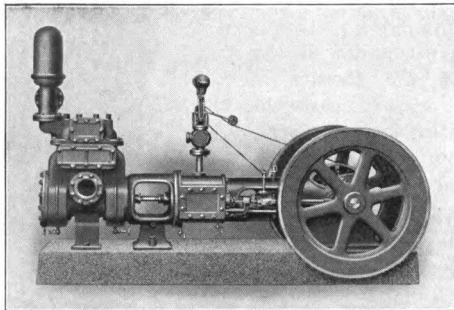
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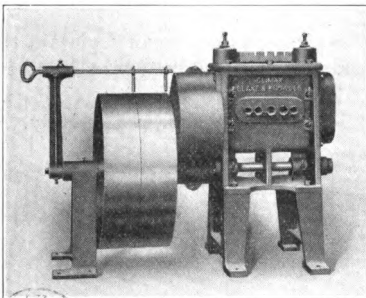
Vertical Pump



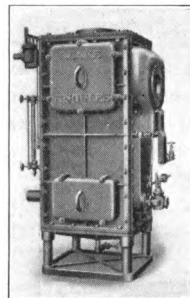
Vertical Pump



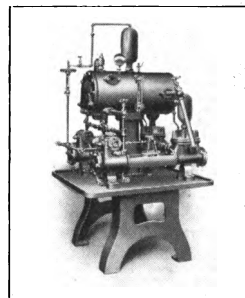
Single Flywheel Cane Juice Pump



Core Wire Straightener



Open Feed Water Heater



Fuel Oil Pumping System

## LAMMERT & MANN CO.

WOOD & WALNUT STS., CHICAGO, ILL.

Manufacturers of Rotary Vacuum Pumps, Centrifugal Pumps, Pressure Pumps  
Engineers—Machinists

### LAMMERT VACUUM PUMPS:

#### Pistonless Valveless Rotary

Our pumps are designed for the *highest possible dry vacuum* and meet a long-felt want for a high grade, high duty pump, where a high, dry vacuum is required.

To give an even, high vacuum there must be no valves to leak or stick, no piston and rings to wear out and the lubrication must be perfect. The LAMMERT pump not only meets these vital requirements, but does it with reliability, low maintenance cost and minimum power.

We avoid wear and leakage by the use of simple device peculiar to the LAMMERT Pump and by constantly flooding oil upon the working parts by auto-

598

matic oilers. With our new silencer and the absence of reciprocating parts, the LAMMERT Pump is free from noise and vibration.

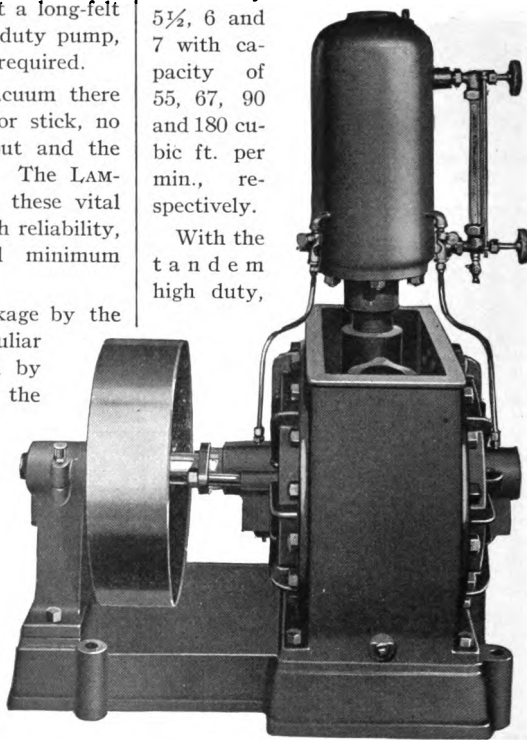
**Styles—Sizes:** LAMMERT Vacuum Pumps are made in several styles and sizes to meet the various demands of service.

The smaller, light service pumps, which are capable of easily attaining a vacuum of 26 inches of mercury, are air-cooled, having exceptionally large radiating surface for that purpose. Size Numbers 2, 3 and 4 with capacity of 7, 14 and 24½ cubic ft. per min., respectively.

The oiling system in these pumps is of the capillary type. The oil reservoir holds a supply sufficient to run the pump for thirty hours. No oil is wasted as the oil starts and stops coincident with the starting and stopping the pump.

The larger pumps are water-cooled and are capable of easily maintaining continuously a vacuum of 27 inches of mercury at sea level. Size Numbers 5, 5½, 6 and 7 with capacity of 55, 67, 90 and 180 cubic ft. per min., respectively.

With the tandem high duty,



Single Stage Water-Cooled Pump

water-cooled pumps we can maintain the highest possible vacuum. Size Numbers 5A, 5½A, 6A with capacity of 55, 67 and 90 cubic ft. per min., respectively.

### CENTRIFUGAL PUMPS CONTRACT WORK

We also build rotary pumps to handle the heaviest products.

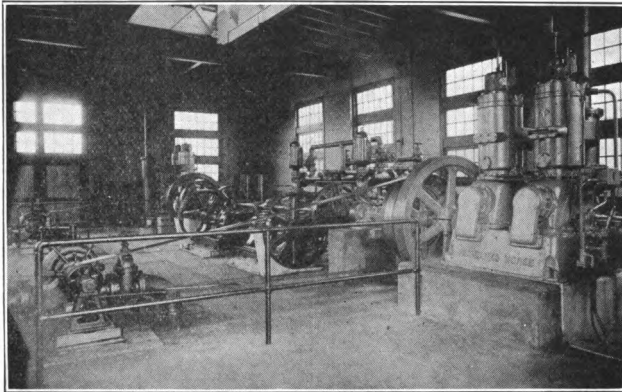




## FAIRBANKS, MORSE & CO.

CHICAGO, ILL.

Manufacturers of Motors, Engines, Oil and Kerosene; Pumps, Steam, Power, Centrifugal; A. C. and D. C., Generators, Alternators, Starters, Etc.; also Scales, All Kinds; Railway Supplies, Motor Cars, Standpipes, Coaling Stations, Etc.; Water Systems; Tanks and Towers; Hoists, Air Compressors, Etc.



This Installation Shows Two "Y" Oil Engines Direct-Connected to Duplex Power Pumps and Belted to Centrifugal Pumps

### "Y" OIL ENGINES:

10 H. P. to 200 H. P.

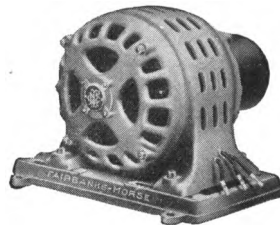
Fairbanks-Morse "Y" Oil Engines 10 H. P. to 200 H. P. have set a new standard of low power costs through efficient use of low priced fuel oils. Simple in construction—practically automatic in operation and regulation—no carburetors, valves, batteries, mixers, timers, igniters, magnetos, switches or spark plugs. Special quick-starting device; air seal prevents oil from being blown out of bearings; positive lubrication; sensitive governor. No hot bulb—no water injection.

### PUMPS—STEAM, POWER, CENTRIFUGAL:

Fairbanks-Morse Pumps are made in all types and sizes for use in practically every industrial, producing, and manu-

facturing field. A long successful service record is being maintained by thousands of installations. Write for bulletin describing the types you are interested in.

### MOTORS A. C. AND D. C.—GENERATORS:



Fairbanks, Morse & Co. are the pioneer manufacturers of ball-bearing motors. We also make sleeve and ring bearing types—A. C. and D. C. and generators and alternators in a large variety of sizes.

## NOVO ENGINE CO.

LANSING, MICH.

**Manufacturers of Novo Gasoline and Kerosene Engines from 1½ to 15 H. P., Hoists, Force Pumps, Diaphragm Pumps, Air Compressors, Saw Rigs, Etc.**



### THE NOVO ENGINE:

Is exceedingly simple and reliable in every way. They are built of the very best possible material for long and continuous service under the hardest of conditions. Novo Engines are frost-proof, simple in construction, with few working parts, and with practically nothing about them to get out of order. Practically anyone can operate the Novo Engines entirely satisfactorily.

600

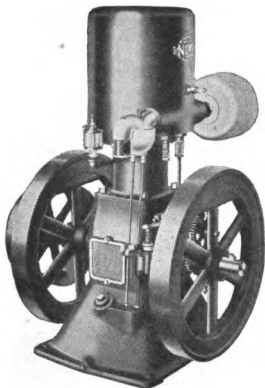


Fig. 255

Novo Engines are built in the following sizes: 1½, 2, 3, 4, 6, 8, 10, 12 and 15 H. P. The 12 and 15 H. P. sizes are of the two-cylinder type.

### NOVO HOISTS:

Are made in forty-four different sizes and types, all combinations, both single and double drum, one or two speeds, reversible or non-reversible. Novo Hoists are light in weight for the power

developed so they are easily moved about. They can be started and stopped as soon as the job is ready and completed so there is no waste of fuel. They take up very little space so can be used anywhere.

The Type DH Hoist shown in Fig. 172 shows the double drum, reversible hoist with 15 H. P. Engine.

The Novo Line also includes a variety of **SAW RIGS** especially built to stand the hard usage demanded of them on all

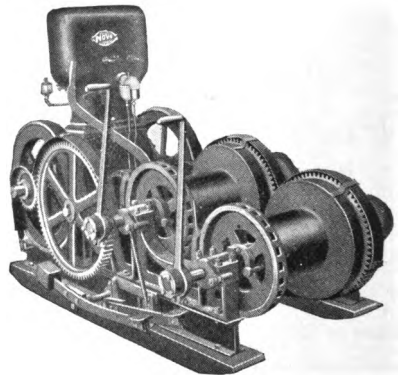


Fig. 172

construction jobs. They will save enough time to pay for themselves on one fair-sized job.

Ask for our special bulletin on Saw Rigs.

We have only illustrated here a small part of the Novo Line. There are two hundred and fifty different sizes and types to choose from.

*You should have our general catalog entitled "Reliable Power," containing description and full specifications of Novo Engines and Outfits.*

## NOVO ENGINE CO.

### NOVO FORCE PUMPING OUTFITS:

Will handle practically any work where a dependable water supply is required.

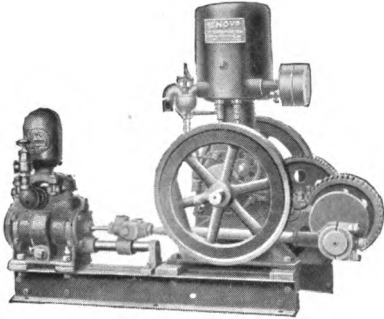


Fig. 14139

The Type U Outfit shown in Fig. 14139 is built for high pressure or long distance pumping. It is especially recommended for the job requiring water under pressure, two or three miles from the source of supply.

### NOVO TRIPLEX PUMPING OUTFITS:

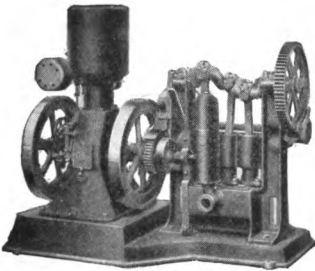


Fig. 1446

Illustrated in Fig. 1446 are also recommended for high pressure pumping where a steady pressure is necessary. The strokes of the three cylinders overlap, thus maintaining a uniform supply. Built in any size up to 15 H. P.

### NOVO DIAPHRAGM PUMPING OUTFITS:

Shown in Fig. 179 mounted on skids or hand trucks with one or two pumps as desired are exceedingly useful for draining excavations, trenches, etc., where muddy and gritty water has to be handled.

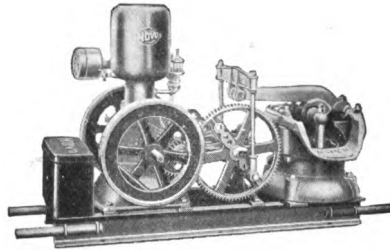


Fig. 179

The Novo Outfits also include chain-driven and direct-connected centrifugal pumping outfits. They move large volumes of muddy or gritty water quickly. 601

### NOVO AIR COMPRESSOR OUTFITS:

Shown in Fig. 276 with single cylinder compressor or double cylinder types, not illustrated, have capacities from 5 to 80 cu. ft. of free air per minute. Will operate all kinds of air tools perfectly satisfactorily.

*Our book, "Reliable Power," gives full information on all Novo Engines and Outfits. Yours for the asking.*

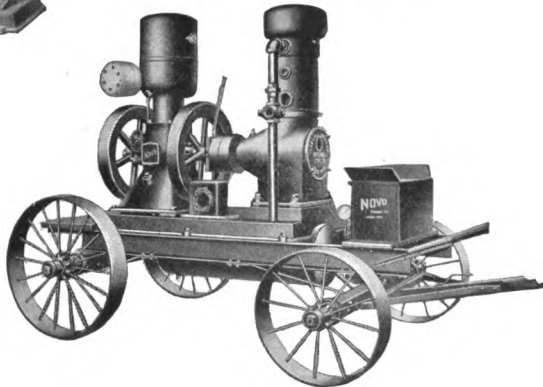
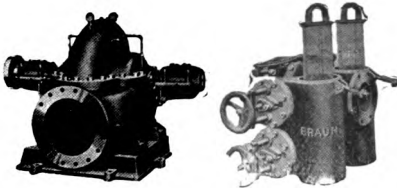
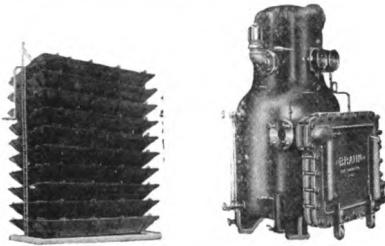


Fig. 276

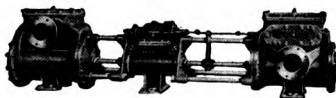
## C. F. BRAUN & CO.

SAN FRANCISCO, U. S. A.

**Manufacturing Mechanical Engineers**



602



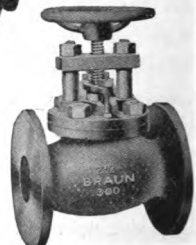
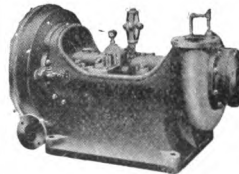
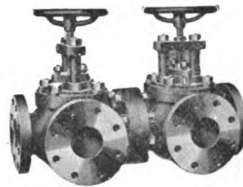
### BRAUN

Feed Water and Service Heaters  
Oil Heaters and Coolers  
Heat Exchangers  
Evaporators  
Distillers  
Condensers  
Atmospheric Cooling Towers  
Turbine and Volute Centrifugal Pumps  
Reciprocating Pumps  
Grease Extractors  
Heavy Service Strainers  
Special By-Pass Valves  
Expansion Joints  
Anchors and Guides  
Pressure and Gravity Filters  
Water Softeners

C. F. Braun & Co., Manufacturing Mechanical Engineers, San Francisco, Cal., U. S. A., is engaged in the development and manufacture of a comprehensive line of auxiliary machinery embodying the best engineering principles of modern practice. All apparatus, covered by United States patents and patents pending, is standardized and built up with the fundamental idea of simplicity, ruggedness and efficiency, bearing in mind the highly important operative factors of accessibility, ease of part renewals, and lightness of weight. We require throughout our organization the best quality of workmanship that system and engineering management can produce.

Our factory, most complete and modern in all respects, consists of Machine, Erecting and Pattern Shops, Iron and Brass Foundries, Copper and Structural Steel Departments.

*Our new catalogue "Braun Auxiliary Machinery" should prove of interest and value to you.*



*Turbine Water Wheels, Water Controlling Apparatus, Etc.*

## RODNEY HUNT MACHINE CO.

83 MILL STREET  
ORANGE, MASS.

Manufacturers of Turbine Water Wheels, Water Controlling Apparatus, Power Transmission Equipment, Underwriter Rotary Fire Pumps, Textile Wet Finishing Machinery

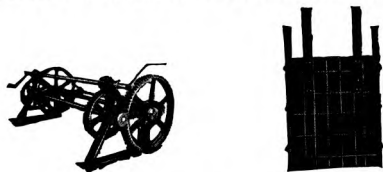


### TURBINE WATER WHEELS:



Hunt—McCormick and Hunt—Francis. Result of over 40 years' effort toward getting the greatest power with best speed and efficiency results. Complete accessory equipment.

### WATER CONTROLLING APPARATUS:



for water power plants, power and storage dams, filtration and irrigation systems. Penstocks, flumes, etc. Relief valves and gauges. Gates and valves. Gate hoists and floor stands. A staff of trained engineers always at your service.

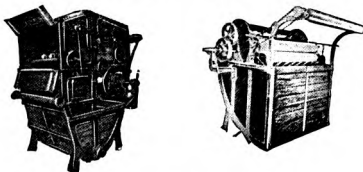
### RAKES FOR TRASH RACKS AND SCREENS:

The best rake you can buy—hence the cheapest. Of pressed steel, unbreakable, light—easy to handle—has extra deep basket. Handle stays in. End teeth guards practically eliminate interference with screen back bars.

With HUNT screens there is no interference. Price \$8; handles extra.

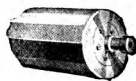


### WE SPECIALIZE IN TEXTILE WET FINISHING MACHINES:



for dyeing, bleaching, rinsing, washing, scouring and fulling goods in the string of roll. Ask about our Type M Fulling Mill, Type F-1 and F-2 combination scouring, fulling and finishing machines, also Washers and HUNT Reel Machines. All have standardized, interchangeable parts instantly replaceable.

### ROLLS FOR EVERY PURPOSE: 603



made entirely in our own factory from the best woods that grow, properly seasoned for the particular work in view. Prompt shipment is one of the things you will like about HUNT roll service. Try us.



Send for Catalog on:

TURBINE WHEELS

WATER CONTROLLING APPARATUS

WET FINISHING TEXTILE MACHINERY

RAKES AND SCREENS

ROLLS

POWER TRANSMISSION EQUIPMENT

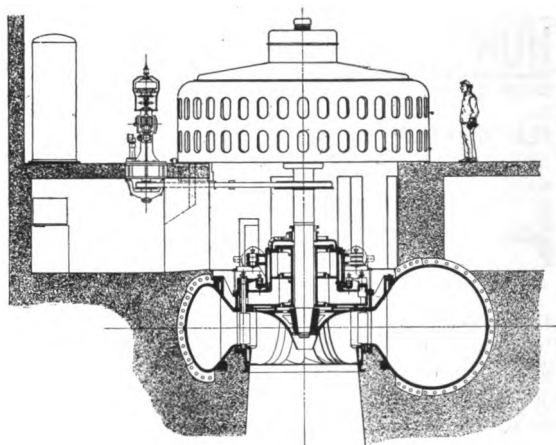
UNDERWRITER ROTARY FIRE PUMPS



# THE WM. CRAMP & SONS SHIP & ENGINE BUILDING CO.

PHILADELPHIA, PA.

Manufacturers of I. P. Morris Hydraulic Turbines



## 604 CAST IRON VOLUTE CASING TYPE:

This illustration shows a cross section through 7500 H. P. turbine in the plant of the Canadian Copper Co. Turbine, Ontario, Canada.

Turbines of the above type are usually installed for heads over 80 feet.

Among the contracts for turbines of this type may be mentioned those listed below.

Total capacity of turbines built or under construction by The Wm. Cramp & Sons Ship & Engine Building Co., 2,085,000 H. P.



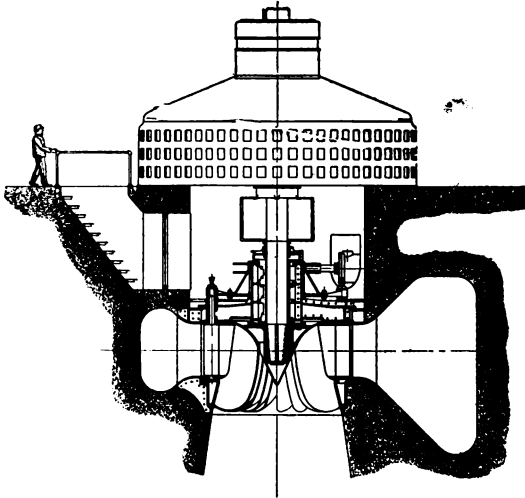
Plant	No. of Units	Head in Feet	R. P. M.	Unit Capacity H. P.	Total Capacity H. P.
Appalachian Power Company, New River, Va.:					
Station No. 2. Exciters.....	2	49	400	430	860
Station No. 4. Exciters.....	2	34	330	250	500
Great Western Power Company, Oroville, Cal.....	4	525	400	18,000	72,000
	2	465	400	18,500	37,000
Phoenix Construction Co. (Utah Pr. & Light Co.):					
Grace Station, Idaho.....	3	482	514	16,500	49,500
Oneida Station, Idaho.....	3	140	180	15,000	45,000
Cove Dev., Idaho.....	1	90	171.5	10,500	10,500
Olmsted Station, Idaho.....	1	338	514	7,700	7,700
Cutler Development, Idaho.....	2	125	180	14,000	28,000
Great Northern Power Company, Duluth, Minn.....	2	355	375	15,000	30,000
Northern Canada Power Co., Timmons, Ont., Can.....	1	34	136.5	2,500	2,500
Rochester Railway & Light Co., Rochester, N. Y.....	2	130	180	16,000	32,000
Keith Paper Company, Turners Falls, Mass.....	1	38	225	1,110	1,110
Canadian Copper Company, Turbine, Ont.....	1	85	150	7,500	7,500
Western Carolina Power Co., Bridgewater Dev., N. C.....	2	115	171.5	13,200	26,400
Riordon Pulp & Paper Co., Hawkesbury, Ontario, Can.....	1	200	450	3,600	3,600
Western N. Y. Utilities Co., Medina, N. Y.....	1	83	300	2,800	2,800
Cienfuegos, Palmira & Cruces Rwy. & Power Co., Cuba.....	2	475	600	9,000	18,000
International Paper Co., Niagara Falls, N. Y.....	2	130	300	5,400	10,800
Hydraulic Power Co., Niagara Falls, N. Y.....	2	213	150	37,500	75,000

Total capacity of turbines of the above type (H. P.)..... 460,770

# THE WM. CRAMP & SONS SHIP & ENGINE BUILDING CO.

PHILADELPHIA, PA.

Manufacturers of I. P. Morris Hydraulic Turbines



605

## CONCRETE VOLUTE CASING TYPE:

The illustration shows a cross section through 20,000 H. P. turbine in the plant of the Laurentide Company Limited, Grand Mere, P. Q., Canada.

Turbines of the above type are usually installed for heads up to approximately 80 feet.

Among the contracts for turbines of this type may be mentioned those listed below:

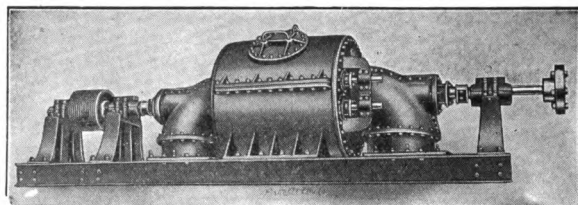
Plant	No. of Units	Head in Feet	R. P. M.	Unit Capacity H. P.	Total Capacity H. P.
Appalachian Power Company, New River, Va.:					
Station No. 2.....	4	49	116	6,000	24,000
Station No. 4.....	3	34	97	3,500	10,500
Mississippi River Power Co., Keokuk, Iowa.....	8	32	57.7	10,000	80,000
J. G. White & Co., Stevens Creek Dev., Ga.....	5	27	75	3,125	15,625
	2	27	200	450	900
Alabama Power Company, Coosa River, Ala.....	4	68	100	17,500	70,000
	1	68	100	19,500	19,500
Cedars Rapids Mfg. & Pr. Co., P. Q., Canada.....	9	30	55.6	10,800	97,200
	3	30	150	1,500	4,500
Laurentide Company, Ltd., Grand Mere, P. Q., Can.....	6	76	120	20,000	120,000
Northern Ontario Light & Power Co., Cobalt, Can.....	2	30	150	1,500	3,000
Turners Falls Pr. & Elec. Co., Turners Falls, Mass.....	6	54	97.3	9,700	58,200
Pennsylvania Water & Pr. Co., Holtwood, Pa.....	1	63	94	16,500	16,500
Columbia Mills Incorporated, Minetto, N. Y.....	6	17.5	68.2	2,200	13,200
Mattagami Pulp & Paper Company, Ontario, Can.....	2	45	112.5	4,500	9,000
Abitibi Power & Paper Co., Ltd., Ontario, Can.....	4	55	128.5	6,000	24,000

Total capacity of turbines of the above type (H. P.)..... 566,125

## J. & W. JOLLY, INC.

HOLYOKE, MASS.

Manufacturers of McCormick Holyoke Turbines, Paper Mill Machinery, Cut Gears, Gray Iron Castings, General Machinery



### McCORMICK HOLYOKE TURBINES:

We are prepared to furnish our standard and special wheels, either cylinder or swing gate, on horizontal or vertical shafts, complete with boiler iron flumes

606 and all connections.

All our standard water wheel patterns have been tested in the official testing flume of the Holyoke Water Power Company and we guarantee at least 80% efficiency.

We also manufacture **Headgates** complete with operating mechanisms, of various designs, for gates opening either vertically or horizontally.

Having our own foundry, pattern-makers and machine shop, we are in a position to make special machinery at any time.

Also Manufacturers of:

"White's" Patent Oscillating Screen

—  
Rag Dusters

—  
Rag Thrashers

—  
Jordan Engines

—  
Beating Engines

—  
Stuff Pumps

—  
Size Pumps

—  
Elevators

—  
Baling Presses



## THE JAMES LEFFEL & CO.

SPRINGFIELD, OHIO, U. S. A.

Manufacturers of Turbine Water Wheels, Steam Engines and Boilers

### LEFFEL TURBINE WATER WHEELS:

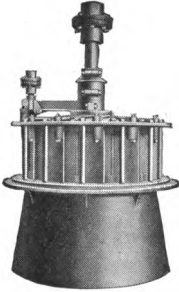


Fig. 1. Vertical Turbine

**Vertical Leffel Turbine Water Wheels:** Equipped with latest type of Leffel steel bucket runners mounted on vertical steel shafts. The revolving parts of these turbines are carried on special design step bearings. The gate casings are fitted with balanced swing type gates, each gate removable separately and fitted with adjustable steel connections. The gates are operated with Leffel's latest type of gate equipment. The bearings are of special designs and large dimensions (Fig. 1).

**Horizontal Leffel Turbines:** Are built in various types and designs, single and double discharges. Frequently to suit requirements two or more turbines are built on one horizontal shaft, developing large horse power and high speeds, for direct connection to driven machinery. Some of these turbines are constructed with steel casings and others for open penstocks (Fig. 2).

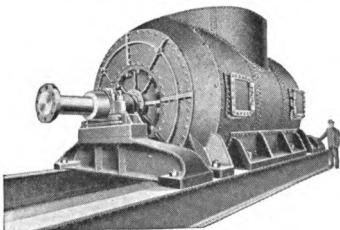


Fig. 2. Horizontal Turbine

**Type "Z" Leffel Turbines:** These turbines of special design for developing high speed, high horse power, high efficiencies; vertical and horizontal designs,

for direct connection to electric generators, milling machines, saws, grinders, pumps and other high speed machinery. These turbines are of the most modern and latest designs in all details.

**Governors:** This Company also furnishes governors for regulating the speed of the different designs and capacities of turbine water wheels. These governors are of the very latest types and designs throughout.

**Guarantee:** All of the work furnished by this company is fully guaranteed to be strictly first class throughout, of latest designs and of strong and substantial construction in all details.

**Catalogs:** Catalogs concerning these turbines furnished on application.

### SPECIAL HYDRAULIC MACHINERY: 607

This Company also builds head gate hoisting machinery, steel piping; also all kinds of power connections, shafting, gearing, pulleys, bearings, bridge-trees and many other designs of hydraulic machinery.

### LEFFEL ENGINES AND BOILERS:

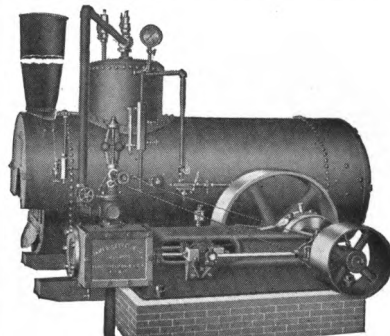


Fig. 3. Leffel Engine and Internal Fired Boiler

This Company also builds a line of Throttling and Automatic Steam Engines and Boilers, Horizontal and Vertical, from 3 H. P. up. Figure 3 shows one of the many styles. Complete illustrated Catalog with full information on request.

## THE PELTON WATER WHEEL CO.

Hydraulic Engineers

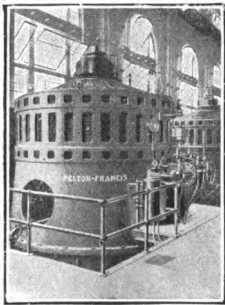
1990 HARRISON STREET  
SAN FRANCISCO, CALIF.

90 WEST STREET  
NEW YORK, N. Y.

Designers and Builders of Impulse and Reaction Turbines, Centrifugal Pumps  
and Water Wheel Governors

### HYDRAULIC TURBINES:

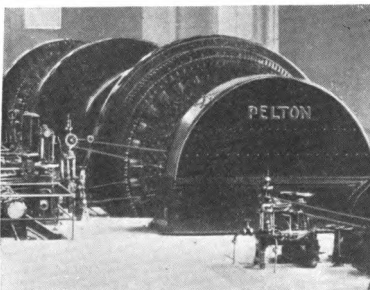
**Reaction Type:** We build all types of Reaction Turbines—low, medium and high specific speeds—for the various conditions under which reaction turbines effectively operate.



608 6500 H. P. Vertical Pelton Reaction Turbine, Regulated by Pelton Governor

Pelton Reaction Turbines now in successful operation vary in size from 10 H. P. to 20,000 H. P., under a range in heads of 30 feet to 650 feet.

**Impulse Type:** Pelton Impulse Turbines (Pelton wheels) are the pioneers in the impulse turbine field.

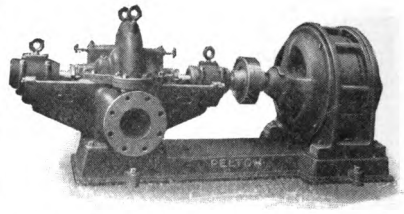


Pelton Impulse Turbines (Wheels) Direct-Connected to Main Generator Units

They are now in successful operation, in sizes ranging from  $\frac{1}{10}$  H. P. to 20,000 H. P., under heads of 30 feet to 2400 feet. The largest single overhung impulse turbine in the world, a 15,000 H. P. single runner Pelton unit, has just been constructed in our shops.

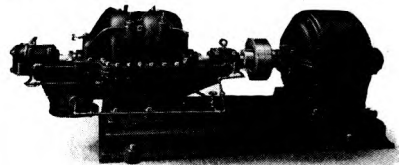
### CENTRIFUGAL PUMPS:

**Standard Designs:** Pelton single-stage, single and double suction pumps are made for irrigation and general industrial service. All standard single suction pumps may be arranged for either belt or direct motor drive without dismantling.



Standard Pelton Double Suction Single-Stage Volute Pump

**Heavy Duty Designs:** Pelton single- and multi-stage, high efficiency turbine pumps are built for waterworks, condenser water circulation and other heavy service, where quality is the principal factor.



Standard Pelton Multi-Stage Turbine Pump

Direct Connected Prime Movers will be furnished with any Pelton pump, when desired.

### PELTON GOVERNORS:

Absolute guarantees of regulation, efficiency, and quality are given with Pelton Governors and Pelton Prime Movers.

Pelton engineers study the specific conditions of each proposed installation and then recommend the type and size of hydraulic equipment that will most effectively meet those conditions.

*Deliveries from Atlantic or Pacific Coast factories. Literature and estimates from either office.*

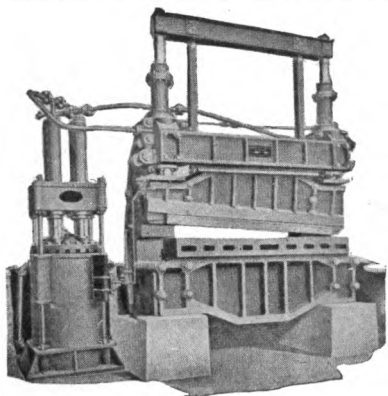
*Hydraulic Machinery, Centrifugal Pumps, Gas Producers, Etc.*

## CAMDEN IRON WORKS

FOUNDED 1848

CAMDEN, N. J.

Builders of Machinery, Plate and Structural Work and General Founders



Hydraulic Tools, Accumulators,  
Riveters, Shears, Plate Benders, Flang-  
ing Presses.

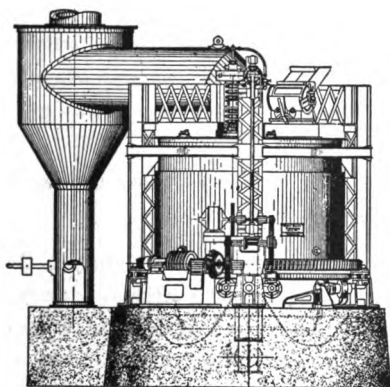
Hydraulic Valves and Leathers.

Cast Iron Pipe.

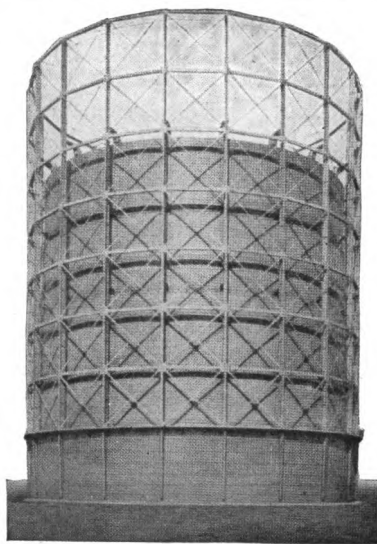
Flanged Pipe.

Cast Iron Rams to 35 ft. long.

Foundry Ladles.



Gas Producers of High Capacity, for  
Raw or Cleaned Gases.



Gas Holders.

Purifiers.

Standpipes.

Tanks for Oil and  
Water.

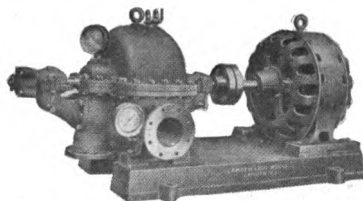
Penstocks.

Steel Pipe.

Theisen Washers for cleaning blast  
furnace gas.

Vacuum Pans.

Hay Rope.



Centrifugal Pumps.

609

## THE CHARLES BURROUGHS CO.

NEWARK, N. J.

**Designers and Builders of Hydraulic Machinery for Any Service  
Pioneers and Patentees of Automatic Hydraulic Presses  
Automatic Machinery of Any Description—Tools, Jigs and Fixtures**

### OUR HYDRAULIC SPECIALTIES:

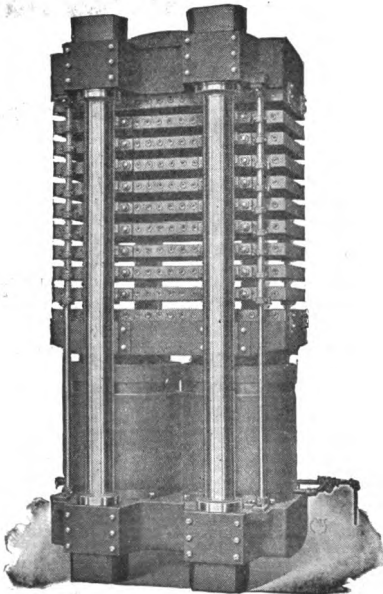
#### Rodless Hydraulic Presses (Patented):

This style of press we recommend as the most rigid and simplest ever constructed, there being no rods to stretch or nuts to work loose. Absolutely parallel surfaces are maintained between the platens.

We can furnish any size and number of platens and any power.

**Hydraulic Rod Presses:** We have been building them for the past forty years for many purposes. Their use being

610



**Multiple Opening Hydraulic Rod Press**

diversified, we require sizes of articles and nature of material you propose to press before we can quote.

**Hydraulic Pumps:** Plain Hand, High and Low Pressure Hand, Belt or Motor Driven, 2, 3, 4 and 6 plunger, with accumulator stop; automatic change high and low pressure; any combination to suit your requirements.

**Hydraulic Accumulators:** Weighted with cast weights, or scrap.

Variable Pressure.

We can always suit your requirements.

A Large Variety Hydraulic Valves and Fittings. Special Steamplates.

**Hydraulic Tools and Machine Tools (Mostly Patented):** Extruding Machines, Dehydrating Presses, Special Moulding Presses, Sheetting Planers, Hubbing Presses, Angle Moulding Presses, Semi-Automatic Moulding Presses, etc.

**Moulds:** Forty years ago we were the pioneer makers of Moulds for "Celluloid" articles. Since then we have made them for every conceivable article in practically all of the compositions known to the art to-day. Steam and gas or electrically heated.

Send us a sample article and we will quote.

**Complete Plans:** For Pyroxylin Compounds (known under various trade names), Shellac Compounds (known under various trade names), Bakelite, Condensite, etc., etc.

*Send for our special catalogue.*

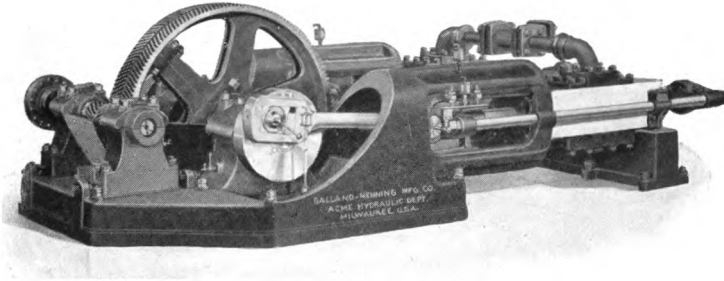
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## GALLAND-HENNING MFG. CO.

26TH-27TH AVE. AND LAYTON PARK  
MILWAUKEE, WIS.

Hydraulic Presses, Pumps and Accumulators

---



Style PH Duplex Double Acting Pump

### HYDRAULIC PRESSES:

For all purposes. Wheel Presses, Shaft Straighteners, Drawing, Stamping, Arbor, Broaching Presses, Etc.

### PUMPS:

High Pressure, Vertical, Horizontal and Double Pressure Pump.

The style PH Duplex Double Acting Pump has a capacity of 39 gallons per minute at 5000 lb. per square inch to 156 gallons per minute at 1200 lb. per square inch.

### BALING PRESSES:

For waste paper, rags, cotton, shoddy, etc. Also for finished textiles.

### SCRAP METAL BUNDLING PRESSES:

For bundling scrap steel, copper, brass, aluminum, sheet wire and stamping. Also soft metal turnings and shavings.

611

### MALTING MACHINERY:

Pneumatic Drum and Compartment Systems.

### DRYING EQUIPMENT:

For Grains, Starch, Glucose, Fruit Pomace, Etc.

### ANGLE BENDING:

For bending and forming angle iron and bars.

## METALWOOD MANUFACTURING CO.

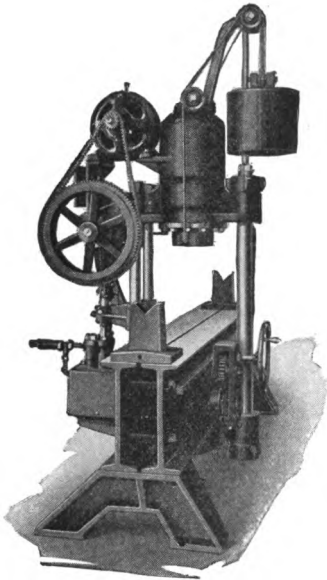
DETROIT, MICHIGAN

SALES REPRESENTATIVES: NEW YORK, PHILADELPHIA, CHICAGO, MONTREAL, TORONTO

Manufacturers of Quick Operating Hydraulic and Hydro-Pneumatic Machinery

### HYDRAULIC STRAIGHTENING PRESSES:

In 35-ton, 50-ton, 65-ton and 125-ton capacities for straightening 3 in. to 6 in. bars and shafts, including our No. 191 Crankshaft Press designed especially for crankshaft straightening.



612

### HYDRO-PNEUMATIC QUICK OPERATING PRESSES:

In 10-, 15-, 20-, 30- and 40-ton capacities for light straightening, broaching, forcing and assembly operations:

### HYDRAULIC PRESSES:

For Vulcanizing and forming in rubber manufacture; leather and coin embossing; metal and plastic material forming presses.

### HYDRAULIC ARBOR PRESSES:

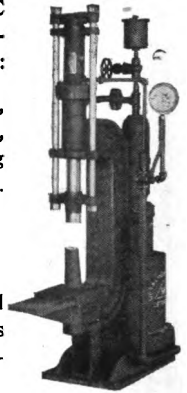
In 35-, 60- and 100-ton capacities for industrial and railroad shop work.

### HYDRAULIC BROACHING PRESSES:

In accumulator or belt driven types.

### HYDRAULIC FORCING AND ASSEMBLY PRESSES:

Horizontal style, Quick Operating types, for rear axle housing and brake drum work.

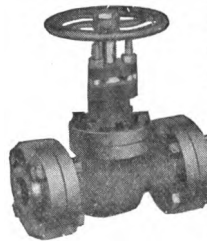


### ACCUMULATORS:

In four types and wide range of capacities for various requirements.

### HYDRAULIC HIGH DUTY PUMPS:

In Horizontal and Vertical types and in capacities  $2\frac{1}{2}$  to 20 gals.



### HYDRAULIC ALLEVIATORS, INTENSIFIERS:

Flanges, pipe and pipe bends, valves, etc., including "Metalwood" Quick Operating type.

### DROP FORGED STEEL HYDRAULIC FITTINGS:

Ells, tees, stop and check valves, flange unions, couplings, bushings, etc.

*Bulletins upon Application.*



REG. U. S. PAT. OFF.

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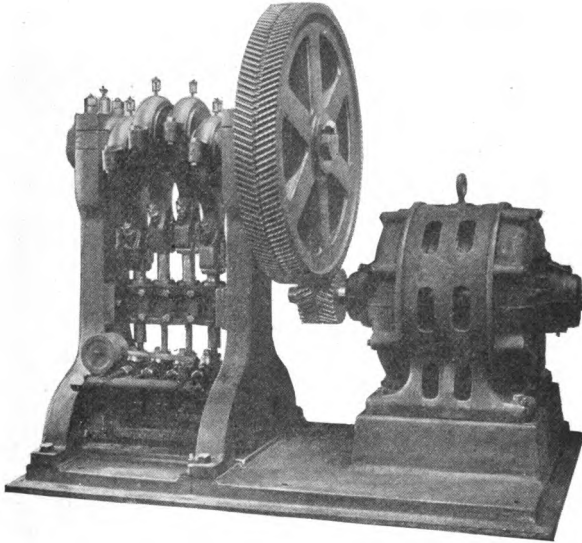
## JOHN ROBERTSON & CO.

(TUBAL CAIN IRON WORKS)

133 WATER ST., BROOKLYN, NEW YORK

Manufacturers of Hydraulic Presses and Hydraulic Pressure Pumps

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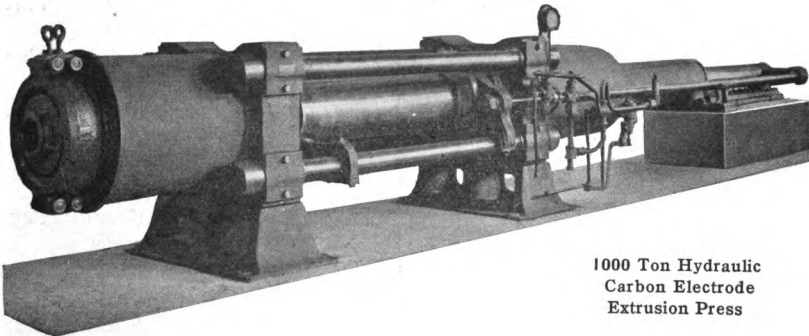
613

High Pressure Pumps—1000 lbs. to 8000 lbs. per square inch

**MANUFACTURERS OF:**

Hydraulic Pressure Pumps.  
Hydraulic Accumulators.  
Hydraulic Valves and Fittings.  
Lead Pipe Machinery.  
Block Tin Pipe Machinery.  
Lead Trap Machinery.  
Solder Wire Machinery.  
Sheet Lead Machinery.  
Lead Incasing Presses.

Hydraulic Embossing Presses.  
Electrotype Moulding Presses.  
Jewelers' Presses.  
Silversmiths' Presses.  
Hydraulic Compression Test Presses.  
Celluloid and Bakelite Presses.  
Electric Carbon Presses.  
Carbon Electrode Presses.  
Hydraulic Bending Presses.  
Hydraulic Forging Presses.



1000 Ton Hydraulic  
Carbon Electrode  
Extrusion Press

*Hydraulic Machinery, Power Tools*

## **SOUTHWARK FOUNDRY & MACHINE COMPANY**

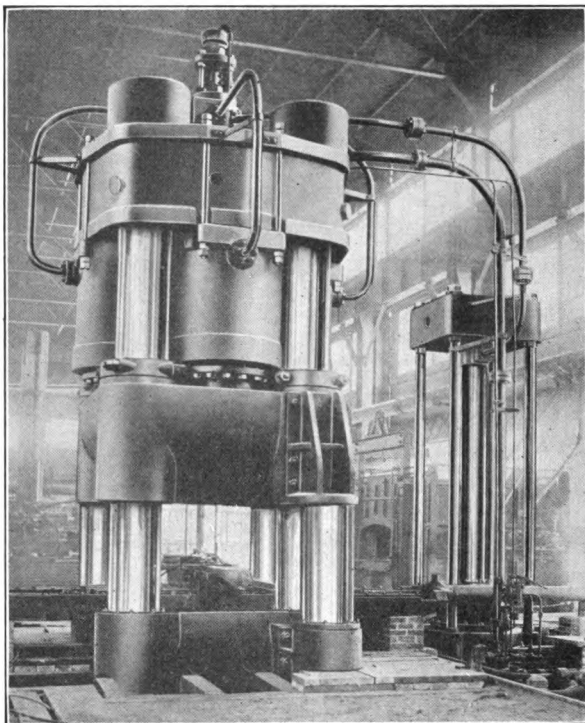
Established 1836

PRINCIPAL OFFICE: 400 WASHINGTON AVE., PHILADELPHIA

DISTRICT OFFICES

Equitable Building, NEW YORK CITY

Brown-Marx Building, BIRMINGHAM



10000 Ton Forging Press

### **DESIGNERS AND BUILDERS OF:**

HYDRAULIC MACHINERY  
BOILER SHOP EQUIPMENT  
SHIPYARD EQUIPMENT  
RAILROAD SHOP EQUIPMENT  
POWER TOOLS  
FLUE WELDERS  
WASHER PRESSES  
POWDER PRESSES  
COMPLETE HYDRAULIC IN-  
STALLATIONS

ACCUMULATORS  
BUSHING PRESSES  
PUSH BENCHES      FLANGING PRESSES  
GATE SHEARS  
PLATE JOGGLERS      JIB CRANES  
KEEL PLATE BENDERS  
OPERATING VALVES      POWER PUNCHES  
PLATE PLANERS  
RIVETERS      BENDING ROLLS  
TEST PRESSES  
SHEARS      TIRE FORGING PRESSES  
WHEEL PRESSES  
VULCANIZERS      GOOSENECK PRESSES  
SIDE RAIL PRESSES  
EXTRUSION PRESSES      FORCING PRESSES  
DRAWING PRESSES



## THE WATSON-STILLMAN CO.

35 CHURCH ST., NEW YORK

Engineers and Builders of Hydraulic Machinery—Pumps, Valves, Accumulators, Intensifiers, Boosters, Jacks, Pitjacks, Lifts, Punches, Shears, Benders, Straighteners, Riveters, Copping Shears, Bolt Forcers, Baling Presses, Bulldozers, Forging Presses, Metal Extrusion Presses, Forcing Presses, Tunnel Shield Cylinders and Equipment, Etc.

*In our long experience of 70 years, we have designed, built and have patterns for over 5000 complete hydraulic machines for practically every use to which hydraulic pressure has been found adaptable.*



### HYDRAULIC PRESSES:



We have a standard line of presses for forcing, force fitting, assembling; presses for broaching, metal forming, metal extruding; presses for die sinking, die forming, embossing; presses for baling metal scrap, cloth, etc.; presses for briquetting of granular materials; presses for forging, drawing, tube drawing; heating presses and chilling presses for forming rubber and composition goods in molds.

### HYDRAULIC ACCUMULATORS:



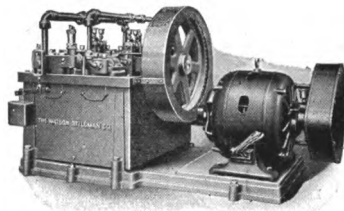
Tank Weighted  
Accumulator

615

We build accumulators in seven types, plain cylinder, inverted cylinder, yoke cylinder, plain and variable pressure, differential ram, hydro pneumatic and intensifier.

### HYDRAULIC PRESSURE PUMPS:

We have given particular attention to the appurtenances necessary to complete hydraulic plant installation. Our line of pumps is complete and contains a standard type for every pressure demand up to 10,000 lbs. per sq. in. and every detail has been worked out to give the maximum of efficiency.



*We are prepared to design special equipment to suit your own specifications.*

## **R. D. WOOD & COMPANY**

PHILADELPHIA, PA.

Engineers, Iron Founders, Machinists

### **HYDRAULIC MACHINERY:**

Hydraulic Accumulators and hydraulic Presses of every description for:

Boiler and Plate shops  
Car shops  
Railroad shops  
Steel mills  
Ship yards  
Rubber and Tire factories  
Powder plants, etc., etc.

### **HYDRAULIC OPERATING VALVES:**

**616** Designed for five hundred to thirty-five hundred pounds working pressure of the leather packed piston or double spindle type. Also stop-check-and shock relief valves.

### **AUTOMATIC GAS PRODUCERS:**

Gasifying 40 to 50 tons of bituminous coal per 24 hours in continuous operation, for:

Open hearth furnaces  
Soaking pits  
Heating furnaces  
Glass tanks  
Lehrs  
Smelting furnaces  
Lime kilns  
Brick kilns, etc., etc.

### **CAST IRON PIPE:**

Bell and Spigot Pipe from 1 inch to 84 inches in diameter, Flange Special deep bell, High Pressure, Flexible Joint



for Submarine Work, Standard and Special Fittings, Heavy Loam and Dry Sand Castings.

### **GENERAL MACHINERY:**

Our shops are well equipped for building large machinery of every description, such as sugar, chemical and similar work.

### **IRON CASTINGS:**

We are especially well equipped for making large and intricate loam castings; also castings in dry sand and green sand.

### **HYDRANTS AND VALVES:**

Fire Hydrants, Mathews patents for standard and high pressure. Gate, Check, Foot and Air Valves, Valve Boxes, Indicator Posts, Foot Valve and Intake Screens, Hood Racks, etc.

## **BUCKEYE IRON & BRASS WORKS**

DAYTON, OHIO

Brass Goods for Engine Builders, Steam and Water Fitters  
Tobacco Cutting Machinery, Linseed and Cotton Seed Oil Machinery  
Castor and Coconut Oil Machinery a Specialty

### **BUCKEYE**

**Extra Heavy Iron Body Throttle Valves**

For High Duty Engines

**High Grade Brass Goods**

**Angle Valves**

Blow-Off Valves

Check Valves

Cross Valves

Gate Valves

Globe Valves

Hot Water Valves

**Radiator Valves**

Steam Stops

Unions

Safety Valves

Hydraulic Valves

Ammonia Valves

Air Cocks

**Cylinder Cocks**

Oil Cups

Brass Lubricators

Whistles

Name Plates

Hose Fittings

Water Gauges

**Brass, Bronze, Copper and Aluminum  
Castings**

### **OIL MILL MACHINERY**

Hydraulic Presses

Chilled Crushing Rolls

Automatic Steam, Hydraulic

and Power Former

Attrition Mills

Disc Hullers

Cake Breakers

**617.**

**Brass and Steel Hydraulic Fittings**

Mechanical Upright Cookers,

full drop charge

Wave Line Grinding Plates

Automatic Cake Strippers

Hydraulic Power Pumps

Accumulators

Change Cocks

Sole Manufacturers of the Celebrated

**PEASE IMPROVED**

**TOBACCO CUTTING MACHINES**

for cutting fine cut, smoking, cigarette  
and piccadura tobacco.

# CHALMERS & WILLIAMS, INC.

GENERAL OFFICE AND WORKS

1450 ARNOLD ST., CHICAGO HEIGHTS, ILL.

Manufacturers of Mining and Crushing Machinery

**PRODUCTS:** Symons Disc Crushers. Also, Jaw Crushers, Stamp Mills, Huntington Mills, Crushing Rolls, Chile Mills, Cyanide Filters, Revolving Screens, Pulsating Screens, Disc Crushers, Tube Mills, Ore Reduction Machinery, Rock Crushing Machinery, Gyratory Crushers and Adjustable Quick Discharge for Tube Mills.

## SYMONS COARSE DISC CRUSHERS:

Crushing is done between two dish-shaped discs of manganese steel set with their concave sides facing each other. These discs rotate in the same direction at the same speed and are supported at an angle to each other.

618

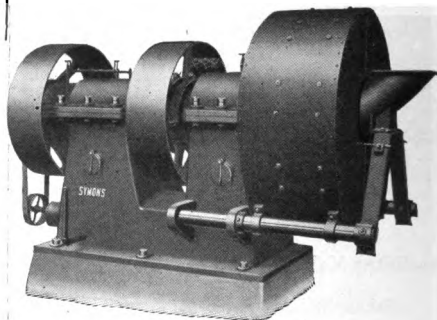
When stone is fed through the central feed opening, it is thrown by centrifugal force into the opening where the discs are widest apart. It is carried around with them to where they are closer together and is crushed in the operation. The smaller particles fly out from between the discs, into the encircling chute, while the larger particles are caught again and the operation repeated.

**Advantages**—Support of the feed spout is adjustable. This spout, being elliptical in cross section, is well adapted to deliver slabby pieces into the crushing cavity. The hood casing completely encloses the crushing members.

An important feature is that the manganese crushing discs wear smooth—

not in grooves. This allows them to be set closer together to take up wear.

**Construction, Feed and Discharge**—The stone or other material, which enters through the central feed spout shown, is quickly spread by centrifugal force over the surface of the discs. Particles are separated—not packed together. The feed is forced and the product thrown out by a force many times stronger than gravity. The quick escape of particles



broken to the proper size avoids unnecessary crushing. This prevents waste of power, avoids undue crushing strains, and results in a minimum of fines.

**Size of Product**—Size of product may be regulated to suit the demands of the trade by changing the distance between crushing discs.

A wide range of adjustment is provided.

TABLE OF WEIGHTS AND CAPACITIES

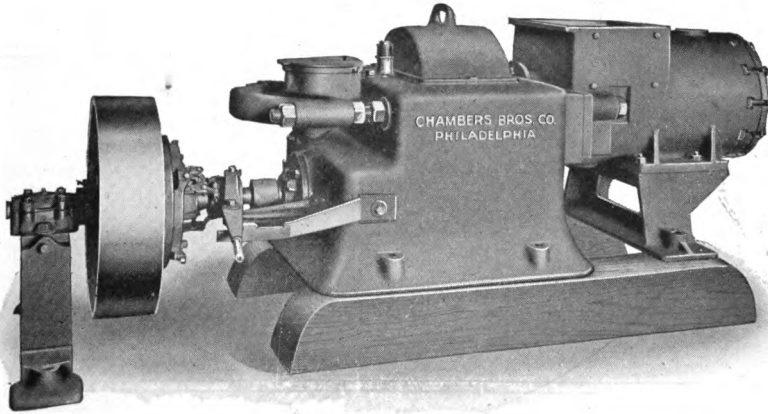
Size of crusher	18-in.	24-in.	36-in.	48-in.
Approx. shipping weight, lbs.	5600	8500	23,500	39,000
Size of feed, ins.	1½	2½	3½	6½
Minimum exit opening for best results, in.	¾	½	¾	1
	Size of ring Tons per hour	Size of ring Tons per hour	Size of ring Tons per hour	Size of ring Tons per hour
Minimum capacity in tons per hour	¾ = 5-8	½ = 12-15	¾ = 25-30	1 = 45-60
	½ = 8-10	¾ = 18-20	1 = 30-45	1½ = 60-80
	¾ = 10-12	1 = 20-25	1½ = 45-60	2 = 80-100
	1 = 12-15	1½ = 25-30	2 = 50-65	2½ = 100-120
R. p. m. main pulley	200	200	133	100
R. p. m. eccentric pulley	450	400	300	250
Size of pulleys, ins.	28 x 8	34 x 10	44 x 14	54 x 16
H. p. required	12-18	18-25	30-40	50-65

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## CHAMBERS BROTHERS COMPANY

PHILADELPHIA, PA.

---



619

**Number 60 Extruding Machine**

### **AUGER MACHINES:**

**For moulding and for compressing plastic materials.**

This particular machine has steam jacketed barrel, cast steel auger, forged steel die plate drilled with a large number of  $\frac{3}{8}$  inch holes. The provision for end thrust is most liberal. Driving gears of steel with cut teeth and encased for constant lubrication. Friction clutch driving pulley 24 x 6 inches. Unboxed weight about 3550 pounds. Other patterns of barrel and of dies will be made to order.

**We specialize on:**

**CLAY WORKING MACHINERY**

\_\_\_\_\_  
**BRICK MAKING MACHINES**

\_\_\_\_\_  
**BRICK REPRESSES**

\_\_\_\_\_  
**ROLLER CRUSHERS**

# THE BONNOT COMPANY

CANTON, OHIO

CHICAGO, ILL.

882 Continental and  
Commercial Bank Bldg.

PHILADELPHIA, PA.

1402 Morris Bldg.

PITTSBURGH, PA.

359 Frick Bldg.  
Annex

620

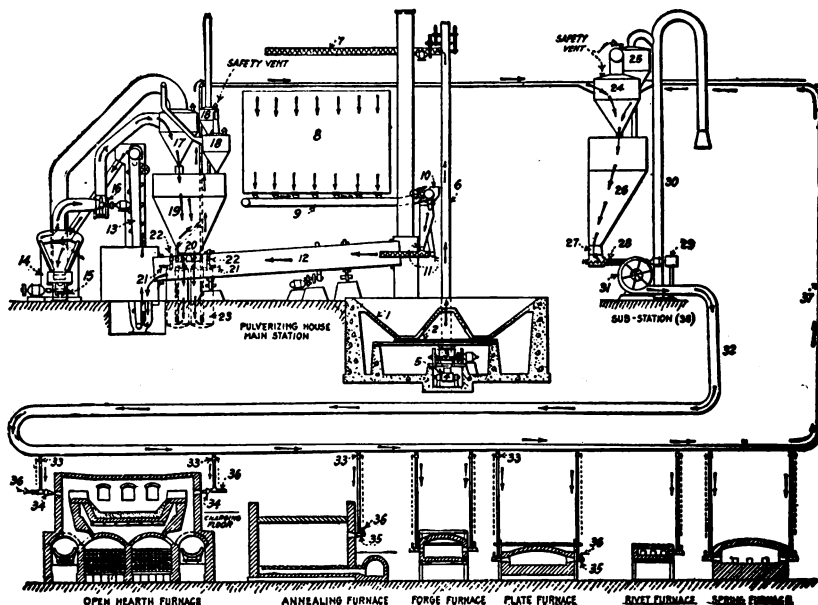


Diagram of a Holbeck Pulverized Coal Installation

## HOLBECK PULVERIZED COAL SYSTEMS:

Central fuel storage, pneumatic distribution, for use in many types of furnaces, including boilers, cement kilns and metallurgical furnaces.

## PORTLAND CEMENT MACHINERY:

Rotary kilns, dryers, pulverizers, tube mills, ball mills.

## BRICK AND TILE MACHINERY:

Building Brick, Paving Brick and Hollow Clay Products.

## BONNOT PULVERIZERS:

For grinding limestone, coal, etc., either with or without air separator.

## BALL MILLS:

For grinding ores.

## F. L. SMITH & CO.

Engineers

50 CHURCH ST., NEW YORK

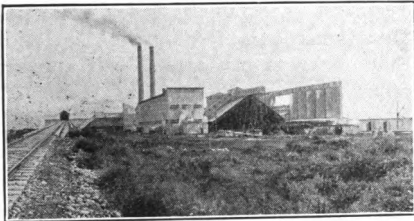
### PRODUCTS:

#### Engineering:

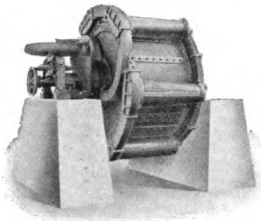
Cement Making Factories  
Pulverized Coal Installations  
Nodulizing of Ores

#### Manufacturers:

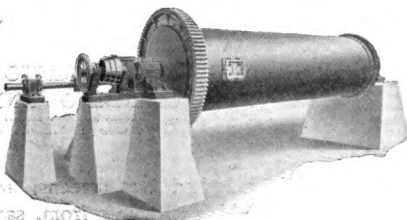
Kominuter	Tubemill
Trix	Lenix Belt Drive
Washmill	Agitators
Exbinner	Slurry Pump
Slurry Feeder	Dry Feeder
Cooler	Kiln
Danish Flint	Cylpebs (metallic
Pebbles	grinding bodies)
Silex Linings	Metal Linings



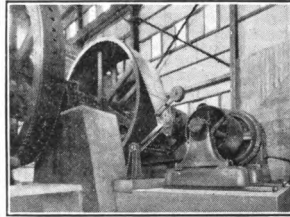
**DESIGN, EQUIPMENT AND  
ERECTION**  
of Portland cement making factories.



**KOMINUTER**  
for wet and dry granulating.

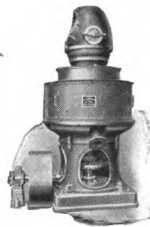


**TUBEMILL**  
for wet and dry pulverizing

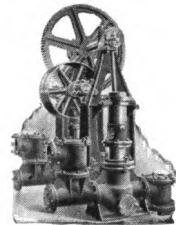


**THE LENIX**

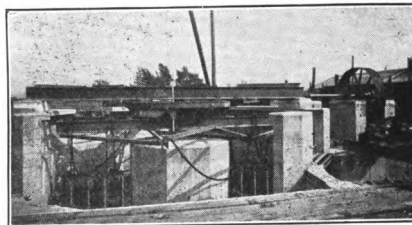
makes belt drives with short pulley centers as efficient as direct connected units, chain or gear drives, saving space, slippage, cost of belts and upkeep.



**THE TRIX**  
for grading granulated materials in a wet state.



**SLURRY PUMP**  
The economical method of transporting heavy liquids like slurry.



**WASHMILL**  
for disintegrating and mixing clay and like materials in water.

621

## E. H. STROUD & COMPANY

Established 1896

928, 930, 932 & 934 FULLERTON AVENUE  
CHICAGO, ILLINOIS

Engineers and Manufacturers of Machinery for the Reduction of All Sorts of Dry Grindable Materials, Animal, Chemical, Mineral, and Vegetable, and Some that Carry 6% to 8% of Moisture; also of Powdered Coal Burning Equipment

### CRUSHING AND GRANULATING ROLLER MILLS:

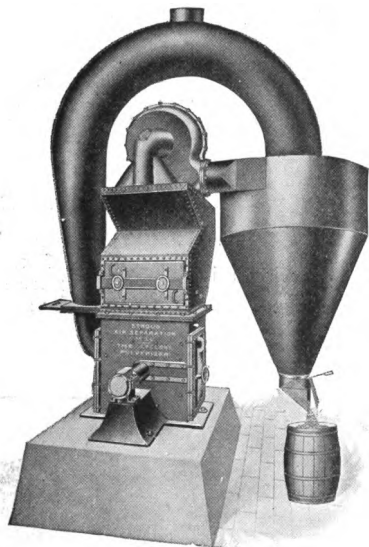
With either pointed or chisel-shaped cutters, one pair, two pairs, or three pairs of rolls high, per mill.

Ask for Bulletin No. 200.

### STROUD AIR SEPARATION PULVERIZERS:

Our illustration shows a Product Collector attached to the Pulverizer. We build Air Vent Chambers too.

622



These mills give a finished product direct which, without subsequent sieving, is so uniformly fine that 95% or 98% or all of it, as wanted, will, if tested when dry, pass through a horizontal brass

wire cloth testing sieve of the desired mesh, which can be any mesh from, say, 40 x 40, down to the most impalpable powders, far finer than a 200 x 200 mesh. They are without exception the most efficient Pulverizers made. Dustless in operation. Difficult to clog. Easy to clean. A cool Pulverizer for chemicals. So automatic in feeding and operation that one man can attend half a dozen mills. Cost of milling very low.

Ask for Bulletin No. 101.

### CAPACITY ON BITUMINOUS COAL TO 100 x 100 MESH—95% FINE

#### SIZE OF PULVERIZER AND ITS OUTPUT IN POUNDS PER HOUR

Class "0"	8-10 H. P. Best Feed Size $\frac{1}{2}$ " cubes	650-850
Class "1"	15-20 H. P. Best Feed Size 1" cubes	2000-2500
Class "2"	25-30 H. P. Best Feed Size 1" cubes	4000-5000
Class "3"	40-50 H. P. Best Feed Size 2" cubes	8000-10,000

### STROUD SCREEN SEPARATION CRUSHING AND GRINDING AND SHREDDING AND PULVERIZING MILLS:

With rigidly locked bar screens, adjustable, for making products from, say, 4 x 4 mesh down to 100 x 100 mesh. Ask for Bulletin No. 102-B. Very efficient machines of this type.



## E. H. STROUD & COMPANY

### STROUD POWDERED COAL STOKER AND BURNER:

Receives the Powdered Coal, draws its own supply of air from the atmosphere, measures the coal and the air as used, mixes them thoroughly, delivers the mixture to the furnace (where it ignites at once), and enables the operator to have complete control of furnace temperatures, and to make records from which

to duplicate his results at will. We build also a Stoker for Locomotives.

Sizes and Capacities from 15 lbs. to 5000 lbs. of coal per hour per stoker with all the air needed for combustion. *Write for Bulletins No. 103-B and No. 107.*

We have been the Pioneers in the art of pulverizing and stoking and burning Powdered Coal under Boilers and some other Heating Units.

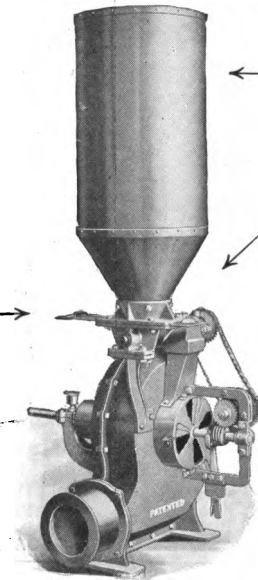
Illustration is of our Left-Hand Stoker. We build Right-Hand as well.

Stoker can also be built for either upward or downward delivery.

Slide to start and stop flow of coal.

Pulley or Electric Motor, or Steam Turbine, as desired.

Outlet of Fuel Mixture.



Patented

The Coal Tank can be of other size and shape, or can be a metal barrel of this shape, if preferred.

Sprockets, Chain, Worm and Gear which drive the Conveyor from spindle of fan and automatically govern the supply of coal.

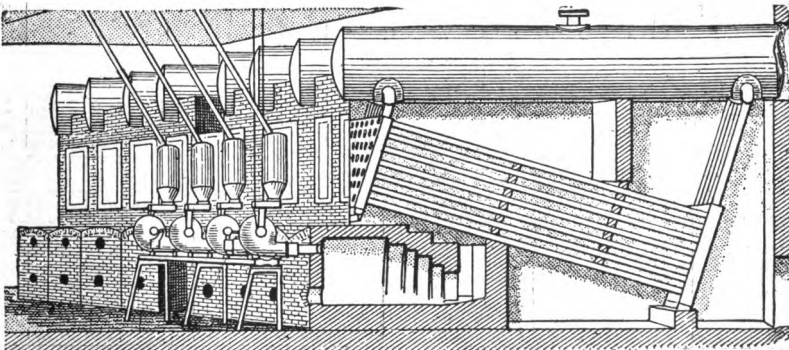
Air Inlet and Controller.

All persons are warned that the ideas embodied in the Stroude Powdered Coal Stoker and Burner are well covered by fundamental patents.

623

### ROUGH SKETCH OF A TYPICAL STROUD METHOD INSTALLATION

We have purposely made an incorrect drawing of the Furnace and some other details because we do not wish to advertise or give away gratis information which has cost considerable time and money and effort. Our installation is as simple as that shown.



# WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

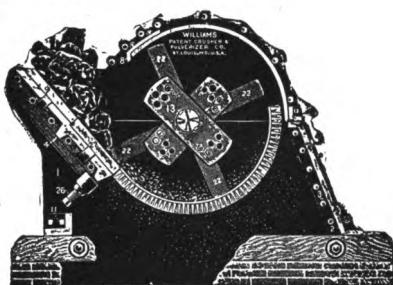
OLD COLONY BLDG., CHICAGO

Manufacturers of Crushing and Grinding Machinery

BRANCH OFFICES: NEW YORK, SAN FRANCISCO, PHILADELPHIA, PITTSBURGH, DETROIT, RICHMOND, VA., CLEVELAND, BUFFALO

WORKS: ST. LOUIS

COAL CRUSHERS FOR COKE OVEN WORK, BY-PRODUCT AND BEEHIVE OVENS:



By the use of the Williams Patent Hammer Crushers with the various adjustable features, the following results are obtained from the ovens: The oven pulls easier, more coke is made from each oven, the ash is reduced, the coke comes out firm, regular in size, does not crumble, and the structure is much improved.

The substantial construction of these machines is plainly shown in this cut; all parts subject to wear are easily adjustable, which includes the hammers,

the discs, the cage bars, and the breaker plates. The housing is entirely protected from wear by heavy liner plates made of heavy chilled iron. The machine is very accessible, as it is made of sectional construction.

## CRUSHERS FOR ANTHRACITE MINE REFUSE:

Our Patent Hinged Hammer Debris Crushers are in extensive use for properly crushing and treating Anthracite debris or Culm before flushing it into the mines.

## CRUSHERS FOR CHAIN GRATES OR STOKERS:

The Williams Patent Coal Splitter takes Run-of-Mine Coal and reduces the same to  $1\frac{1}{2}$ ",  $1\frac{1}{4}$ ", 1",  $\frac{3}{4}$ " and finer with the "minimum amount of fine dust" the only machine made that can be regulated to properly size coal. All parts are adjustable to wear; the crusher is also adjustable to give most any size coal desired.

We also crush Coal and Pitch for Briquette Plants—for Coal Washers, before and after washing, and make a specialty of sizing Coal for all Commercial Purposes.

### SPECIFICATIONS REGULAR COAL CRUSHER

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour				Speed	Size Pulley		Extreme Dimensions			Horse Power	W'ght
	In.		$\frac{1}{2}$ " & finer	$\frac{1}{4}$ " & finer	$\frac{1}{8}$ " & finer	R. P. M.	Dia.	Face	L'gth	W'th	H'ght		P'nds	
1	15x12	Run of Mine	30- 40	25- 30	20- 25	1000	20"	15"	6'	6'6"	3'9"	20-25	6500	
2	20x12		45- 55	40- 50	30- 40	1000	20"	15"	6'	7'6"	3'9"	30-35	7500	
3	30x16		65- 80	60- 70	45- 60	1000	20"	15"	6'	8'6"	3'9"	50-60	9500	
4	40x18		100-115	80- 90	60- 80	1000	24"	18"	6'	9'0"	3'9"	75-80	10500	
5	50x20		120-140	100-110	75-100	1000	24"	20"	6'	9'6"	3'9"	100	12000	
6	60x20		150-175	116-130	100-120	1000	24"	22"	6'	11'0"	3'9"	125	16200	

### JUMBO SPECIFICATIONS

5	30x24	R.O.M.	150-175	120-140	80-100	750	24"	18"	8'10"	9'	5'4"	85-100	20000
6	36x24		180-200	145-165	120-140	750	30"	20"	8'10"	10'	5'4"	140-150	24000
7	48x30		225-250	200-220	150-175	750	30"	24"	8'10"	11'	5'4"	165-185	28000
8	60x30		275-300	250-275	180-200	750	30"	24"	8'10"	13'	5'4"	200-250	30000

### BRIEF SPECIFICATIONS STOKER COAL CRUSHER

No. of Crusher	Hopper Opening, Inches	Weight	Horse Power	Capacity—Tons per Hour R. O. M. to $1\frac{1}{2}$ " and Finer
1	15x18"	6500	15 to 20	25 to 40
2	20x24"	7200	20 to 25	50 to 60
3	30x24"	9500	40 to 50	75 to 100
4	40x24"	10500	60 to 75	100 to 125
5	50x24"	12000	85 to 100	135 to 175
6	60x24"	16200	100 to 125	180 to 220

# WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

## RAW MATERIAL GRINDERS FOR CEMENT AND GYPSUM PLANTS:

### UNIVERSAL MILL



This *Universal Grinder* is the *only* machine of its kind made. Will take DRY 2" Limestone, Shale, Clay, or Coal, and deliver at one operation a product 95% through 20 mesh TUBE MILL FEED WITHOUT OUTSIDE SCREENS OR SEPARATORS. *No other* machine can deliver the fine uniform product year in and out.

## VULCANITE RE-CRUSHER

These Vulcanite grinders will take raw material, limestone, shale, clay or coal in cubes of 3 inches and under, and reduce the same to  $\frac{1}{4}$  inch or  $\frac{1}{8}$  inch. This makes an excellent feed for those plants which use roller mills as finishers in the raw end.

### We issue the following catalogs:

No. 45-E, Coal Crusher Catalog—For all those crushing and grinding coal, etc.

No. 45, Cement and Limestone Catalog—Limestone, Gypsum and Similar Grinders.

No. 45-B, Fertilizer Catalog—Bone, Tankage, Shells and Fertilizer Work.

No. 45-A, Clay Catalog—Clay, Shale, etc., for Brick, Tile and Terra Cotta.

No. 45-C, Oil Cake Catalog—Linseed, Cottonseed and Similar Oil Cake Grinders.

No. 45-F, Shredder Catalog—Bark, Chips, Cork and all Fibrous Materials.

No. 45-D, Stock Food Catalog—All Cereals for Feed Millers, Alfalfa, etc.

Mention material you wish to crush or grind and we shall see that you receive the proper catalog and specifications.

### COMPLETE SPECIFICATIONS UNIVERSAL MILLS

Size Mill	Size Feed	Diam. Mill	Capacity per Hour Dry Stone Tons		Speed R.P.M.	Horse Power	Floor Space Extreme Dimensions			Size Pulley		W'ght
			12 Mesh	20 Mesh			L'gth	Width	Height	Diam.	Face	
0	1"	18"	$\frac{3}{4}$	$\frac{1}{2}$	1800	10-12	5'	5' 1"	3' 2"	8"	8 $\frac{1}{2}$ "	2500
1	1 $\frac{1}{2}$ "	26"	2-4	1-3	1600	15-20	6' 3"	5' 10"	3' 8"	16"	10 $\frac{1}{2}$ "	4000
2	1 $\frac{1}{2}$ "	26"	5-6	3-5	1600	20-25	6' 3"	6' 3"	3' 8"	16"	12 $\frac{1}{2}$ "	5000
2xx	2"	26"	6-8	5-6	1600	30-35	6' 3"	7'	3' 8"	20"	15"	6500
3	2"	40"	10-12	8-10	1100	50-60	7' 6"	6' 10"	5' 4"	20"	15"	12000
4	2 $\frac{1}{2}$ "	40"	13-15	10-13	1100	65-75	7' 6"	7' 10"	5' 4"	20"	18"	14000
5	2 $\frac{1}{2}$ "	40"	16-20	15-18	1100	80-100	7' 6"	8' 6"	5' 4"	20"	20"	16500
9	3"	60"	25-35	20-30	750	150-175	12'	9' 2"	7' 2"	30"	24"	30000

### VULCANITE SPECIFICATIONS

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour			Speed R.P.M.	Horse Power	Extreme Dimensions			Size Pulley		Wt.
			$\frac{1}{2}$ "	$\frac{3}{8}$ "	$\frac{1}{4}$ "			L'gth	Width	Height	Diam.	Face	
1	14"x 5"	1 $\frac{1}{2}$ "	4	3	2	1500	15-18	4' 8"	6' 3"	3' 3"	16"	10 $\frac{1}{2}$ "	4200
2	18"x 6"	2"	7	5	3	1500	20-25	4' 8"	6' 6"	3' 3"	16"	12 $\frac{1}{2}$ "	5000
2xx	24"x 6"	2"	10	8	6	1500	30-35	4' 8"	7'	3' 3"	20"	15"	6000
3	18"x 8"	2 $\frac{1}{2}$ "	20	18	15	1000	40-50	5' 2"	7'	4'	20"	15"	10000
4	24"x 8"	3"	30	27	25	1000	70-75	5' 2"	7' 4"	4'	20"	18"	12000
5	30"x 8"	3"	35	30	28	1000	90-100	5' 2"	8'	4'	20"	20"	14000
6	36"x 10"	3"	40	35	30	1000	110-125	5' 2"	9'	4'	20"	22"	15500
7	40"x 10"	3"	50	42	35	1000	125-150	5' 2"	9' 6"	4'	22"	24"	17500

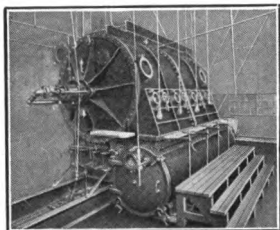
## J. P. DEVINE COMPANY

BUFFALO, N. Y.

Manufacturers of Vacuum Drying and Impregnating Apparatus

### VACUUM DRUM DRYERS:

For Dyewood and Tanning Extracts, Milk and Food Products, Pastes, etc. This type of machine affords a rapid and uniform drying because the drum takes up but a very thin film of the wet material. The water is then evaporated from the material, leaving the dried sub-



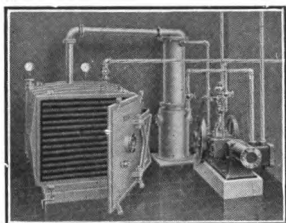
Devine Vacuum Drum Dryer

stance on the drum to be taken off by our improved method. The drying process is continuous and independent of climatic conditions, free from dust, and uniform. Adapted for all solutions and liquors containing solids.

626

### VACUUM CHAMBER DRYERS:

For Colors, Dyes, Extracts, Salts, Rubber, Smokeless Powder and High Explosives and other Chemicals and Food Products. Materials which are difficult to dry in the atmosphere without decomposition can be handled rapidly and effi-



Devine Vacuum Drying Chamber with Surface Condenser and Vacuum Pump

ciently in this type of dryer without any danger of impairing their qualities. The Vacuum Drying Chamber is designed to remove the water rapidly and at a low temperature, assuring uniform drying and low operating cost. Best suited for all materials that can be handled on trays or pans.

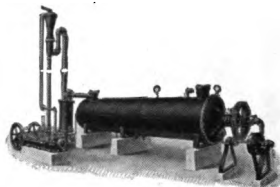
**VACUUM PUMPS**—all sizes and capacities, high efficiency units, steam, belt or motor driven.  
**CONDENSERS**—Jet and Surface Types.

**DIGESTORS, EXTRACTORS, STILLS, FILTERS, WASHERS, PERCOLATORS.**

**SOLVENT RECOVERY APPARATUS.**  
**TANKS** of all descriptions.

### VACUUM ROTARY DRYERS:

For Starch, Granular Substances and Chemical Products. The moist material is charged into the dryer and by means of a high efficiency



Devine Rotary Vacuum Drying Apparatus

Dry Vacuum Pump and Condenser, furnished as part of the unit, a high vacuum is produced, the vapor being pulled over into the condenser and condensed. Concentric with steam-jacketed outside cylinder is a revolving drum, heated by live or exhaust steam, to which stirring blades are attached. Material to be dried is between the inside drum and outside cylinder, kept in constant motion by the stirring blades. Thus, every particle comes into intimate contact with the heating surfaces, periodically, and a thorough, even drying results. Designed for all material that can be tossed or mixed in the drying.

### IMPREGNATING APPARATUS:

For Armature, Field, Magnet and Transformer Coils, Power and Telephone Cables, Piano Sharps, Pencil Slats and other Wood Products,



Devine Impregnating Outfit

Leather Fabrics, etc. This is a combination vacuum drying and impregnating apparatus, the coils or material to be handled first being dried under vacuum, thereby removing both air and moisture from the interior as rapidly as from the surface. The compound is then drawn into the impregnating tank, and penetrates to the innermost recesses of the material, and to render this penetration more thorough, air at artificial pressure is admitted into the Impregnation Tank above the surface of the compound.

## J. P. DEVINE COMPANY

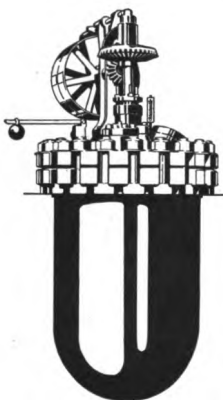
BUFFALO, N. Y.

Manufacturers of Chemical Plants and Evaporating Apparatus

### AUTOCLAVES:

All sizes and capacities, of cast steel for high pressure, also of bronze, copper, etc., equipped with or without stirring device, thermometer, pressure and safety valves and all necessary openings in cover.

Autoclaves built in units having a holding capacity of  $\frac{1}{4}$  gallon to 250 gallons, and for working pressure up to 1000 lbs.



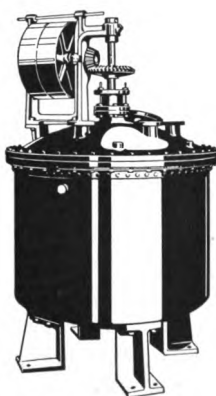
High Pressure Steel Autoclave

### NITRATING, SULPHONATING AND FUSION KETTLES:

All sizes and capacities made of all materials for any requirement.

These units built with or without stirring device, and supplied with or without reflux condensers.

Units also arranged for heating with fuel oil, gas, or steam jacketed.



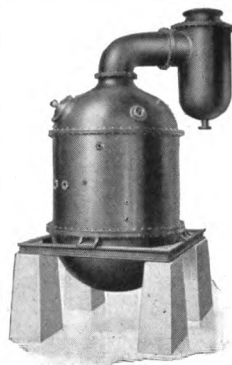
Nitrating Kettle

### COMPLETE PLANTS BUILT AND INSTALLED:

For the production of Aniline Oil, Benzol, Beta Naphthol, Paranitriline, T. N. T., Salicylic Acid, H. Acid, Naphthalene, Dimethylaniline, Dimethyldiphenyl Urea, Sulphur Black, all of the coal-tar derivatives, the higher intermediate colors and dyestuffs, etc., etc.

### VACUUM PANS, EVAPORATORS:

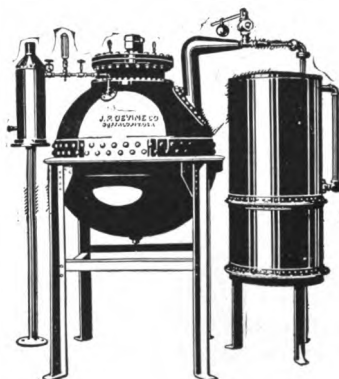
In single or multiple effect, all sizes and capacities made of cast iron, sheet steel, copper, bronze, etc., with horizontal or vertical tubes, and calandria type.



Devine Vacuum Pan

### DIGESTORS, STILLS AND COLUMNS:

Built for the handling of all materials, and arranged for all requirements.



Devine Digestor and Condenser

### EQUIPMENT FOR THE CHEMICAL AND ALLIED INDUSTRIES. CASTINGS FOR THE CHEMICAL TRADE:

CAUSTIC POTS, STEAM JACKETED ACID RETORTS, VALVES, DEFECATORS, STEAM JACKETED VACUUM STILLS, PIPING, VULCANIZERS, MIXING TANKS, Etc., Etc.

SPECIAL APPARATUS OF ALL KINDS BUILT BY US.

Let us know the problems you have in mind, and we feel sure our past experience and engineering staff can be of service in the solution of same.

## L. O. KOVEN & BROTHER

OFFICE: 154 OGDEN AVE., JERSEY CITY, N. J.

N. Y. WAREROOMS  
50 Cliff Street, New York City

WORKS  
JERSEY CITY, N. J.

**Engineers, Manufacturers, Machinists and Designers. We Fabricate Plate Steel, Copper, Brass, Tin, Aluminum, etc., of Any Shape. Designers and Makers of Special Apparatus for Manufacturing Industries**

We are prepared to do plate work of every description for Ships, Mills, Mines, Factories, Plantations, Chemical Works, Paint Works, Paper Mills, Abattoirs, Fertilizer Plants, Water Works, Government Work, Sewage Systems, etc. We also make and design Special Apparatus and Machinery to meet the progress in all lines of business. *WE HAVE THE FACILITIES FOR IMPROVING YOURS.*

### A Partial List of What We Make:

628 AIR WASHERS  
ALCOHOL RECOVERY AND PURIFYING APPARATUS  
ALCOHOL STILLS  
AUTOCLAVES  
BOTTLE STERILIZERS  
BREAD RACKS  
CANS  
CAN WASHERS  
CANNED GOODS STERILIZERS  
CHEESE VATS  
CHINA KILNS  
COIL BOILERS  
CONDENSED MILK COOLERS  
COPPER LINED STEEL TANKS  
CREOSOTING TANKS  
DIGESTERS  
DRINKING GLASS STERILIZERS  
DRYING APPARATUS  
EXHAUST MANIFOLDS  
EXTRACTORS  
FILTER PRESSES  
FRUIT WASHERS  
GALVANIZED TANKS  
GASOLINE TANKS  
GASOMETERS  
GLASS KILNS  
GLASS STERILIZERS

GLUE DISSOLVERS  
GUM WASHERS  
HAM BOILERS  
HOT WATER TANKS  
HUMIDIFIERS  
JACKETED TANKS  
KILNS  
LEAD LINED TANKS  
MALT TANKS  
METAL MELTING FURNACES  
MILK MACHINERY  
MIXERS  
MUFFLERS  
OIL FILTERS  
OIL WASHERS  
OYSTER WASHERS  
PASTEURIZERS  
PERCOLATORS  
PIE RACKS  
PIPE (RIVETED)  
PLATING TANKS  
RUBBER LINED TANKS  
SAND BLAST TANKS  
SHIPPING DRUMS  
SPRAYERS, FRUIT TREES  
SPRAYERS, PAINT  
SOLVENT RECOVERY STILL  
STEAM KETTLES  
STERILIZERS  
STILLS  
SMOKE STACKS  
TANKS (AIR, GAS, OIL AND WATER)  
TUMBLERS  
VACUUM PANS  
VARNISH TANKS  
VEGETABLE WASHERS  
VULCANIZERS  
WASHERS FOR CANNERIES  
WATER STILL

# THE PFAUDLER CO.

ROCHESTER, NEW YORK

NEW YORK  
110 West 40th Street

CHICAGO  
1442 Conway Bldg.  
DETROIT  
1946 Penobscot Bldg.

SAN FRANCISCO  
512 Sharon Bldg.  
ST. LOUIS  
440 Pierce Bldg.

Manufacturers of Glass-Lined Steel Equipment

## PARTIAL LIST OF INDUSTRIES USING PFAUDLER GLASS ENAMELED STEEL EQUIPMENT:

Dairy Products	Celluloid
Canned Goods	Pharmaceuticals
Beverages	Toilet Preparations
Synthetic Colors	Fruit Products
Sulphonated Oils	Smokeless Powders
Printing Inks	Lacquers
General Chemicals	Picric Acid
Hydrogenated Edible Oils	Lemon Extracts
	Invert Sugar

## PARTIAL LIST OF SOLUTIONS PFAUDLER GLASS ENAMELED STEEL EQUIPMENT IS USED TO CONTAIN:

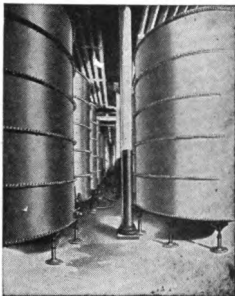
10% Solution of HCl	Conc. Nitric Acid
Concentrated HCl	Sodium Phosphate
4% to 5% Sulphuric	Nitrate of Mercury
Conc. Sulphuric Acid	Zinc Chloride
25% Nitric Acid	Distilled Water

## GENERAL TYPES OF PFAUDLER GLASS-LINED STEEL APPARATUS:

Storage Tanks	Cascade Dishes
Mixers	Truck Tanks
Cooking Kettles	Nitrators
Vacuum Pans	Sulphonators
Percolators	Weigh Tanks
Crystallizing Pans	

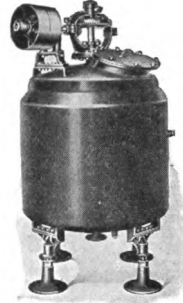
*Special Literature to the Chemical, Pharmaceutical, Dairy, Food and Beverage Industries to be had upon application.*

## PFAUDLER SECTIONAL STORAGE TANKS (Glass-Lined Steel):



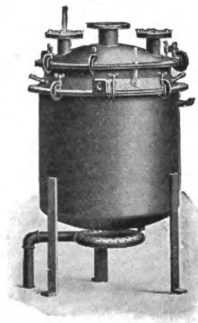
The tanks shown are of the vertical type. They are 12 feet by 10 feet inside. Capacity 7600 gallons. Pfaudler Sectional Tanks may also be had mounted in a horizontal position. Made in a wide variety of sizes and capacities to fit individual requirements.

## PFAUDLER SINGLE PIECE MIXER (Glass-Lined Steel):



The body of this tank is a single piece of Open Hearth Sheet Steel. The entire tank interior as well as the agitator is enameled with Pfaudler Glass Enamel. Capacity of tank shown is 200 gallons, and it is 42 inches by 36 inches inside. It may, however, be had in many different sizes and capacities up to 2500 gallons. Prices on application. **629**

## 26 GALLON PFAUDLER UTILITY POT (Glass-Lined Steel):



For the small scale manufacture of Chemicals and Pharmaceuticals and for laboratory use. Send for folder "What the Chief Chemist Said," giving complete specifications and showing special condensing, agitating, and lifting and tilting mechanisms for use in conjunction with this equipment.

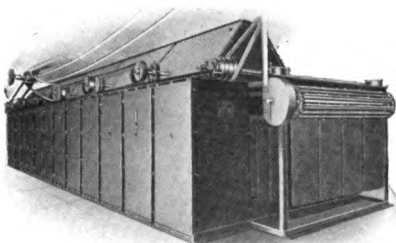
## THE PHILADELPHIA DRYING MACHINERY CO.

MAIN OFFICE AND WORKS,  
STOKLEY ST., ABOVE WESTMORELAND PHILADELPHIA, PA.

BOSTON OFFICE: 53 STATE ST.

**Manufacturers of Dyeing, Bleaching and Drying Machinery**

### "HURRICANE" DRYERS:

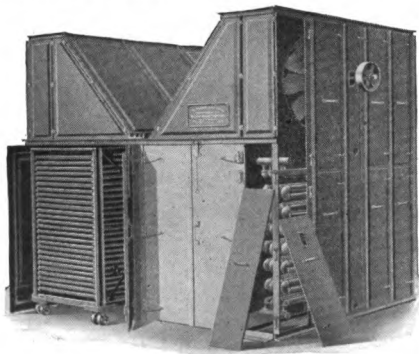


Automatic Bag Dryer

"Hurricane" Dryers have proven efficient and economical and are designed to give the highest Quality of Work.

**630** Machines built in many standard sizes and capacities. Here follow a list of some of the materials which are being dried:

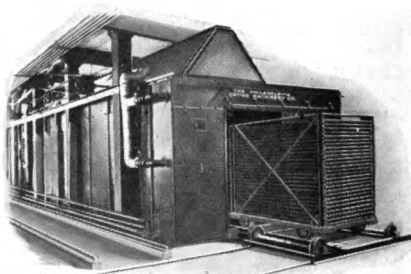
Artificial Leather	Fire Brick
Asbestos Board	Flax
Asbestos Pipe Covering	Fruit
Binders' Board	Gas Masks
Carpets	Hair
Chemicals	Hollow Tile
China Ware	Hosiery
Clay Wares	Leather
Cloth	Leather Board
Cocanut	Linters
Copra	Nitrate of Soda Bags
Cotton	Paints
Dyestuffs	Pigments
Electrical Porcelain	Plush



Truck Dryer for Chemicals, etc.

Porcelain  
Rags  
Reclaimed Rubber  
Sanitary Porcelain  
Silk Piece Goods  
Spark Plugs  
Straw Braid  
Sugar Bags

Terra Cotta  
Tobacco  
Toweling  
Underwear  
Vegetables  
Wool  
Yarn

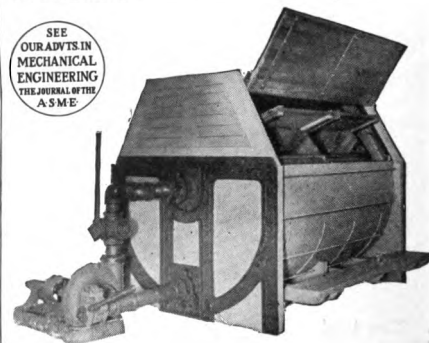


Tunnel Truck Dryer with Trays

### BLEACHING AND DYEING MA- CHINERY:

Complete Dyeing, Bleaching, Finishing and Drying Equipments for Hosiery, Toweling and Underwear.

Circulating Dyeing Machines for all kinds of Skein Yarn, Braid, Tape and Raw Stock.



Rotary-Circulating Dyeing and Bleaching Machine

*Complete information and descriptive catalogs sent upon request.*

SEE  
OUR ADVERTS IN  
MECHANICAL  
ENGINEERING  
THE JOURNAL OF THE  
A.S.M.E.



# PHILADELPHIA TEXTILE MACHINERY COMPANY

SEVENTH STREET AND TABOR ROAD  
PHILADELPHIA, PA.

CHICAGO, ILL.  
Hearst Building

CHARLOTTE, N. C.  
Realty Building

PROVIDENCE, R. I.  
Howard Building

HAMILTON, ONT., CAN., W. J. Westaway, Sun Life Bldg.

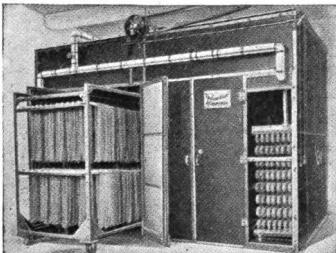
## PROCTOR DRYERS:

Are made for every drying need. In truck, tray, tunnel and automatic types. All-metal fireproof construction.

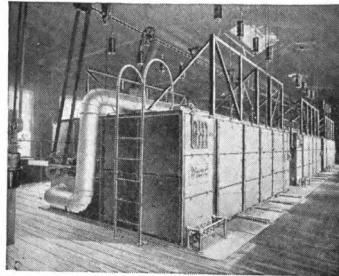
Proctor Engineers specialize on dryers and drying. They have studied the requirements of many industries. They have tested and proved in actual practice the solution of a large variety of drying problems. They have developed a standard line of Proctor Dryers to meet the exacting needs of the industries here listed.

Drying problems containing new elements frequently have to be solved. The engineering facilities of the Proctor Research Department are complete for making tests and experiments in the drying of any kind of material. Untried conditions and new materials are investigated on a commercial scale.

The Proctor Organization with its experience and the facilities of the Research Department is ready to coöperate with you in the design, layout and solution of any drying problem.



Proctor Dryer for Yarns, Tapes, etc.



Proctor Dryer for Chemicals, Paint Colors, White Lead, etc.

**"Proctor"**  
DRYERS

631

for

Yarns	Rags
Chemicals	Silk
Lithopone	Stockings
White Lead	Underwear
Hair	Turkish Toweling
Leather	Felt Hats
Hair Rope	Fur Hats
Glue	Straw Hats
Shoe Shanks	Straw Braid
Leather Board	Gas Mantles
Binders' Board	Cartridges
Asbestos Board	Potato Pulp
Pipe Covering	Paint Pigments
Paper	Labels on Cans
Tobacco	Brick and Tile
Soap	Clay Products
Veneers	Cloth
Barrel Staves	Cocoonut
Thin Lumber	Copra
Match Sticks	Fruits
Tooth Picks	Vegetables
Wool	Screen Cloth
Cotton	Carpet

*In writing for a Proctor Dryer Catalog, please specify material to be dried.*

*Submit your drying problems to us.*



## RUGGLES-COLES ENGINEERING CO.

50 CHURCH ST., NEW YORK CITY

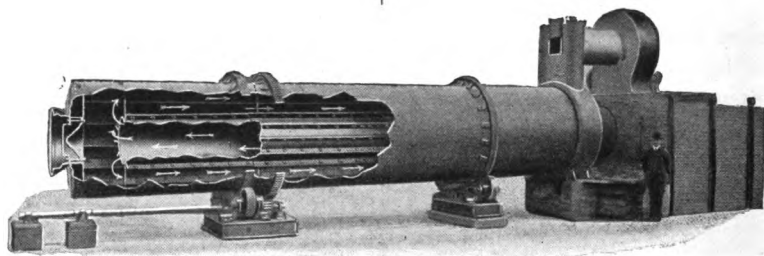
McCormick Bldg., CHICAGO

WORKS: YORK, PA.

Consulting Engineers and Manufacturers of Drying Machinery

We build **RUGGLES-COLES DRYERS** for drying a large variety of in-organic and organic materials. As different materials require different kinds of treatment in drying, naturally no one type

through the inner cylinder and returns between the outer and inner cylinders to the fan, passing on the way the material to be dried. By reason of the inclination and revolution of the dryer the material



Section of Ruggles-Coles Dryer "Double-Shell" Showing Direction of Gases

632

of apparatus can be adapted to all drying processes. We have designed, and now build, seven distinct types of machines. These cover the whole field of drying as completely as possible. For peculiar drying problems, we modify one of our regular type of dryers, or make special apparatus, to suit requirements. With over twenty-one years of experience in this line of work, together with the fact that we have installed over 1000 machines, we are confident of being able to handle any problem in drying which may be submitted to us.

**Class "A" Dryer.**—The principle of the Ruggles-Coles "Double-Shell" Dryer is that the material being dried passes the hot gases in the opposite direction to their travel. The Class "A" dryer consists of two concentric shells rigidly connected at the center. Between this point and each end are two sets of swinging arms allowing for unavoidable expansions and contractions. The inner cylinder at the head or feed end is connected with the furnace by a flue lined with fire brick. At the discharge end is a revolving head on the inside of which are lifting buckets so that the material is delivered out through the central casting.

The furnace is independent of the machine and located in a convenient place, although generally placed close to the head of the dryer. The heated air passes

is carried to the discharge end.

This dryer is especially suitable for drying cement rock, clay, coal, ores, sand, gypsum, fuller's earth, sewage sludge, tankage, etc., etc.

**Class "B" Dryer.**—For materials which cannot be dried by direct heat on account of the danger from ignition or injury of the materials by furnace gases, we build a dryer similar in all respects to the Class "A" machine except the gases are taken from the inner flue and returned through a number of tubes, so that it does not come into direct contact with the material being dried.

**Class "C" Dryer.**—For materials which cannot be dried by direct heat, we build a steam dryer which consists of single shell with a steam head at one end and threaded into which are steam pipes. This dryer is set on a slight inclination so that the water of condensation drains in the steam head as rapidly as formed and is automatically blown out. This machine is especially suited for such materials as grains and other organic substances.

**Class "F" Dryer.**—When the quantity of material to be dried is small or the amount of moisture to be evaporated is slight, we build a dryer of single shell construction, and while not as economical in fuel cost as our Class "A" dryer is much lower in first cost.

# SWENSON EVAPORATOR COMPANY

945 MONADNOCK BLOCK, CHICAGO

CABLE ADDRESS: "EVAPORATOR, CHICAGO"

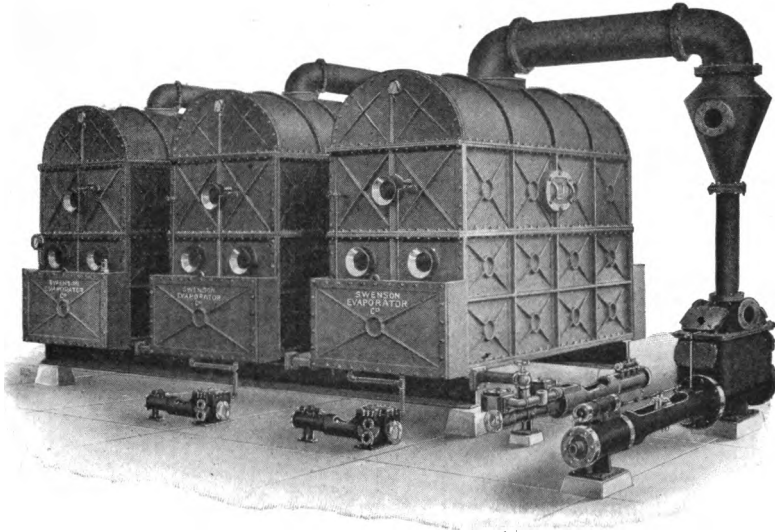
## PRODUCTS:

Evaporators, Single and Multiple Effects; Leaching Batteries; Pulp Mill Machinery; Special Chemical and Waste Product Machinery.

**EVAPORATORS:** Multiple effect evaporators represent the only economical system of removing large quantities of water from dilute solutions. Practically all the concentrating can be done with waste, *i. e.*, exhaust steam.

this matter in detail, illustrating with blue prints as well as photographs.

**Experience:** Our thirty years of experience in this special line has resulted in a machine that is almost fool-proof and as automatic as it is practical to build it. Over a thousand successful installations, more than half of which were repeat orders from the largest purchasers of evaporators, indicate as no other way



633

**Material Handled:** Any liquor concentrated in commercial quantities. See list in our catalog.

**Size:** Swenson Evaporators have been built in all sizes handling from 100 to 15000 gallons per hour.

**Types:** We manufacture five standard types of evaporators. When our regular types do not satisfactorily meet all conditions our engineers design special types or combinations of types to produce the desired results. Our catalog explains

can, the high regard for our experience and record of achievement.

**Catalog:** Our catalog explains in detail what an evaporator does; the reasons for its great economy, etc. We have included tables giving steam and water consumption for various capacities; also list of customers, materials handled, data required for quotations, etc. It has been used in many technical schools as a text book.

## ATMOSPHERIC CONDITIONING CORPORATION

435 CHESTNUT ST., PHILADELPHIA

Canadian Representatives  
DARLING BROTHERS, LTD.  
120 Prince Street  
MONTREAL

European Representatives  
ATMOSPHERIC STEAM HEATING CO., LTD.  
22 Broadway, Westminster, S. W.  
LONDON, ENGLAND

Representatives in the principal cities of the United States

### MANUFACTURERS OF EQUIPMENT FOR MAINTAINING ARTIFICIAL AT- MOSPHERIC CONDITIONS IN IN- DUSTRIAL PLANTS:

The addition of the proper percentage of humidity to make up deficiency.

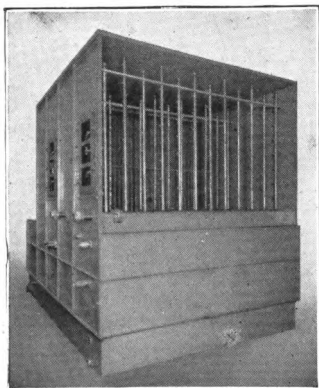
The removal of excessive humidity when high moisture content in the air prevents proper drying or carrying out of certain processes.

Maintaining either high or low temperatures where local conditions or specific materials demand such treatment.

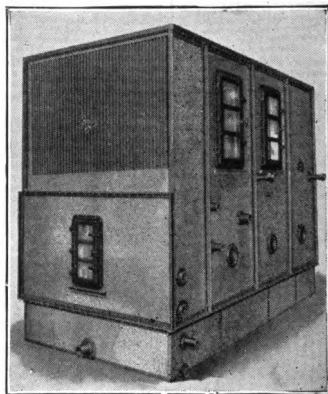
634 The maintenance of uniform humidity conditions within 2% of that for which it is set.

The maintenance of working spaces at the Comfort Zone to insure efficiency of employees.

The cleansing and cooling of air for the Ventilation of Turbo Alternators, equipment commonly known as GENERATOR COOLERS.



Webster Dehumidifier Showing Spray Chamber End



Webster Dehumidifier Showing Eliminator End

### WEBSTER AIR WASHERS:

TYPE "A" APPARATUS, designed primarily for air washing in connection with ventilating systems in public buildings, where a moderate cooling effect by evaporation is desired.

TYPE "B" APPARATUS, designed for air washing in public buildings and industrial plants, where the greatest possible cooling effect by evaporation is desired.

WEBSTER SYSTEM OF HUMIDITY CONTROL may be applied to the various types of Webster Air Washers, Humidifiers and Dehumidifiers. Perfect in principle and accurate in operation—the chief controlling thermostat subject to water, a medium with four times the specific heat of air.

Consult us regarding air conditioning apparatus for any purpose. Send for Bulletins as they are produced.



## CARRIER ENGINEERING CORP'N

39 CORTLANDT ST., NEW YORK

Consulting, Designing and Contracting Engineers  
Specialists in Air Conditioning and Drying

### BRANCH OFFICES

BUFFALO, Prudential Bldg.  
BOSTON, 176 Federal Street

PHILADELPHIA, Land Title Building  
CHICAGO, Transportation Building

### SERVICES AND PRODUCTS:



TRADE MARK

Consultation, Designs, Construction, Equipment and Installation, complete or in part, of plants for the purpose of Humidifying, Dehumidifying, Cooling, Air Washing, Automatic Temperature and Humidity Regulation, and Drying.

### EXPERIENCE AND CO-OPERATIVE SERVICE:

Our claim to consideration is based upon extensive research and experimentation by America's pioneer engineers in these lines, upon long experience in design and installation, upon enviable records by hundreds of prominent installations made under our direction, and last, but not least, upon our eagerness to keep every client permanently pleased.

what is now contemplated and what you should have.

**The Carrier System Has the Flexibility to Meet Every Commercial Requirement in Air Conditioning.**

Humidifying or dehumidifying alone.

Humidifying or dehumidifying with heating.

Humidifying or dehumidifying with cooling.

Humidifying with cooling in summer and heating in winter.

Humidifying with heating in winter and dehumidifying with cooling in summer.

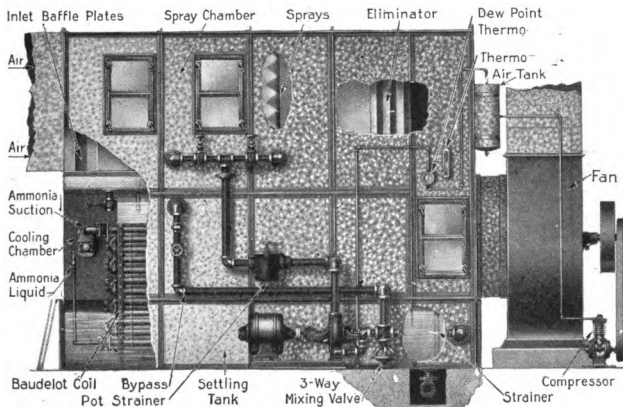
Maintenance of uniform temperature or humidity or both.

Maintenance of uniform relative humidity.

635

*Thorough Ventilation and Air Washing in All Instances.*

The performance of every Carrier



Illustrating a Typical Carrier Installation

By securing our co-operation with engineers or architects on difficult air conditioning work, time and money are saved and protection furnished against faulty or unsuitable selection, and proportion of parts.

A conference between your engineers and ours may show big differences between

installation is guaranteed upon unmistakable terms, and if you will tell us about your air conditioning problems we will send instructive literature and give you some valuable suggestions.

Exclusive rights to the Carrier methods of humidity control.

## **PARKS-CRAMER COMPANY**

FITCHBURG, MASS.

BOSTON OFFICE  
1102 Old South Bldg.

SOUTHERN OFFICE AND SHOP  
CHARLOTTE, N. C.

### **Industrial Piping and Air Conditioning**

#### **PARKS-CRAMER SPECIALTIES:**

**The Merrill Process of Fluid Heat Transmission:** A means for obtaining and transmitting heat at high temperatures and low pressures for industrial processes. Superior to superheated steam, electricity or direct fire.

A special non-explosive fluid, mechanically circulated, passes through a scientifically constructed heat Absorber. Thence it is delivered through pipes to the apparatus to be heated—jacketed kettles, stills, tanks, etc. After delivering a certain predetermined portion of its heat, the circulating fluid returns through the pump to the Absorber for re-heating. The entire system is under static pressure from an expansion tank open to the atmosphere. The only added pressure, rarely exceeding 25 lbs., is that required to maintain circulation against internal frictional resistance.

The system is applicable to the following industries:

Chemical plants.

Rubber works.

Asphalt melting and coating plants.

Melting and refining works.

Oven heating.

Japanning plants.

Paper coating mills.

Canning factories.

Shoe shops.

Plants using hot calender rolls or presses.

Varnish, paint and shellac works.

Each case is a separate engineering problem. On request preliminary data sheets will be furnished from which tentative estimates may often be submitted. These must invariably be checked later by a personal inspection of local conditions before a definite contract price can be quoted. Our engineers are always at your service for consultation.

**Air Conditioning Systems:** We make five types of apparatus including the central station, spray, and atomizer principle of operation.

The Turbo-Humidifier is a highly efficient but very simple humidifying apparatus; readily and quickly adjustable; of relatively small cost for installation and maintenance.

The water is not under pressure; the amount used may be regulated at one point for the system in a room, or group of rooms, or by means of suitable valves controlling the individual nozzles; and in the latter case the initial adjustment of the nozzle members would not be disturbed. While the quantity and fineness of the spray to meet widely varying requirements can be regulated, simplicity of construction and easy accessibility for adjustment or cleaning have been retained together with a low cost of production.

**Humidity and Temperature Regulation:** Our regulators embody the result of many years of pioneer experience.

**Industrial Piping:** In this department, both as engineers and contractors, all kinds of industrial piping problems are handled, such as—

Power Plant Piping.

Forced Circulation Hot Water Heating.

Fuel Conservation Engineering and Piping.

Automatic Sprinkler Fire Protection.

Pipe Bending.

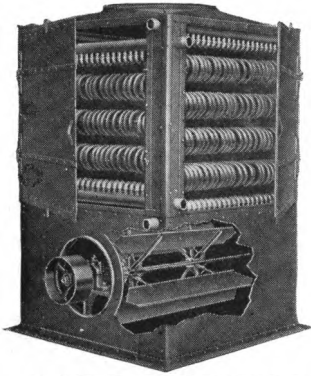
## SKINNER BROS. MFG. CO.

10TH & TYLER STS., ST. LOUIS, MO.

**Manufacturers of Baetz Heating Systems, Drying Systems for all Purposes**

### **BAETZ AIR-HEATING APPARATUS:**

The Baetz Patented Air Heating System is in successful operation in many of the largest foundries and industrial plants in the United States and it has been demonstrated time and again to be the



**Skeleton View of Baetz Heater**

ideal system for the heating of large exposed buildings.

We are willing at any time to back our judgment by placing BAETZ PATENTED AIR Heating Systems on trial for heating, drying or removal of steam, in any plant no matter how exposed it may be and we will guarantee satisfactory results or remove the system without cost.

### **Construction of the Baetz Heater:**

The Baetz Patent Heater is constructed of heavy steel plates and angles. The upper part is occupied by coils of steam pipe. The blower or fan is placed beneath them in the same enclosure.

The air is drawn in by the fan from two sides and is forced upward against the steam-heated coils, and passing out at the top as heated air. The fan does not handle the heated air, but takes the cold air as it passes directly into the blower.

### **The Warming System:**

The Baetz system of factory warming provides an even distribution of warmth throughout even the largest buildings, without the need of distributing pipes.

This result is possible of accomplish-

ment only because the Baetz Air Heater draws the cool air in at the bottom and discharges it vertically through the heating coils. This causes a steady, though unnoticeable, movement of all the air within the room, the heated air constantly moving away from the heater and towards the walls, where it becomes cooler and falls, then is drawn back and into the blower to be heated again.

### **Various Uses of the Baetz Heating System:**

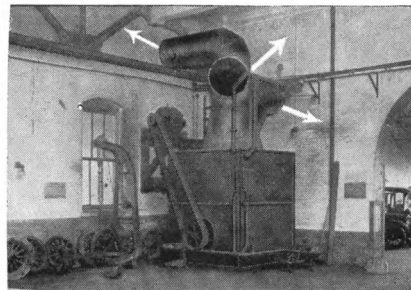
Some of the large packing houses and paper mills which are troubled with steam or vapor have them installed for the purpose of removing this difficulty. For drying purposes they are used in fire brick works, candy manufacturing concerns, shoe manufacturing concerns and others whose business requires a drying system.

### **Special Features:**

**637**

Live steam direct from boiler, or exhaust steam may be used.

Heater is shipped set up, ready for steam connection.



**Installation of Anheuser-Busch, St. Louis, Shows Three Outlets Supplied from One Heater**

Floor space occupied is less than one-third of what any other system requires.

Low cost of maintenance and uniform heat distributed.

Units can be removed from place to place, as there are practically no pipes or distributing ducts used with our installation.

## THE AUTOMATIC REFRIGERATING CO.

MAIN OFFICE AND WORKS, HARTFORD, CONN.

BRANCH SALES AND SERVICE OFFICES:

New York City  
Boston, Mass.  
Chicago, Ill.

San Francisco, Cal.  
Los Angeles, Cal.  
Seattle, Wash.

Washington, D. C.  
Cleveland, Ohio  
Louisville, Ky.

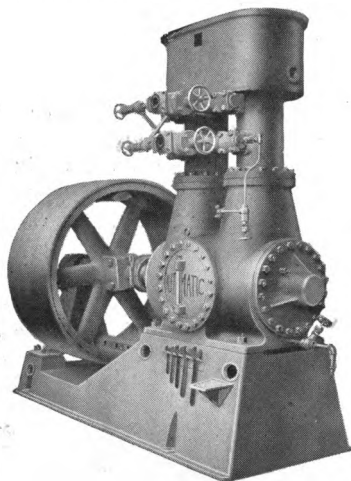
Atlanta, Ga.

Rochester, N. Y.

### AUTOMATICALLY CONTROLLED REFRIGERATING AND ICE-MAKING PLANTS:

These plants (fully patented) are designed to provide mechanical refrigeration without the necessity of an operating engineer. Automatic devices absolutely control starting and stopping of machine as temperatures in boxes rise above or fall below predetermined points, and also control ammonia expansion and feed of water to condenser. Safety devices immediately stop plant in case of trouble with water or electric power service.

**Compressors:** The compressors are of the vertical, two cylinder, single acting enclosed type of rugged construction built to gauge with parts interchangeable. They have safety heads, balanced suction valves and adjustable discharge valves. Cylinders and pistons are specially designed to prevent oil pumping into expansion piping. All wearing parts can be replaced at small expense from the large stock of parts always carried. Machines of this construction can never wear out, and can always be kept at the highest efficiency.



**Compressor Capacities:** Single units from 1000 pounds to 32 tons Refrigeration per 24 hours.

**Automatic Control:** The control equipment is thoroughly reliable, and is rugged in construction.

Automatic Refrigeration originated with, and has been developed to its present state of perfection by this Company. These Automatic control devices are fully patented, and are manufactured exclusively by this Company, and installed only in connection with apparatus put out by this Company.

**Thermostat:** The Thermostat automatically controls the starting and stopping of the machine so as to maintain any desired temperature within a degree or two of a predetermined point.

It insures that power is consumed only when the temperature requires it. As it is used with our automatic electric control panel, there is no arcing or pitting of the contact points.

**Automatic Switchboard:** The starting and stopping of the motor by the various automatic devices are through a specially designed switchboard which has automatic safety devices that shut the machine down and cut off all power in the event of trouble in the electric service, preventing danger of damage to motor.

**Automatic Expansion Valve:** The Expansion Valve automatically controls the feed of ammonia to the expansion coils, thus maintaining the most economical pressure for the expansion of the liquid ammonia in the coils. It is easily adjusted, and functions perfectly.

**Automatic Water Regulator:** The Water Regulator automatically controls the flow of water to the condenser, and automatically adjusts the water use to the requirements of the plant. The action of the water valve is powerful and positive, and water waste is eliminated.

**Automatic High Pressure Safety Cutoff:** This device automatically stops the machine should the head pressure approach the danger point, due to failure of water supply or any other cause. It puts the plant in operation again when the cause of the high pressure is eliminated.

**Repair Parts:** All parts of the plant are of superior construction and are interchangeable. A stock of parts is always carried which can be shipped promptly. No delay or holding up of apparatus while a new part is being constructed.

**Advantages:** The Automatic Refrigerating plant will produce refrigeration at a lower cost than any other electrically driven refrigerating machinery. The plant requires practically no attention other than occasional oiling and cleaning of the machinery.

The temperatures in any number of refrigerators can be maintained at any desired point by one plant. Air circulation in refrigerators is always lively as ammonia is always present in coils.

The many advantages of refrigeration by direct expansion can be fully realized through the Automatic plant. There are many Automatic plants cooling from ten to fifteen refrigerators at different temperatures on the one direct expansion system. The elimination of the cost of operating a brine pump and the extra equipment required for an indirect system, is possible only with an Automatic plant.

An Automatic plant can be located anywhere in a building without reference to the location of the engine room. This is an especially desirable feature for engineers designing equipment for factories and public buildings.

Engineers and Architects are urged to use the expert services of the Engineering Department of this Company to assist them in the solution of special problems in application of mechanical refrigeration. Factory drinking water, Restaurant and Commissary Department installations are applications whose possibilities are beginning to be appreciated.



## FRICK COMPANY, INC.

MAIN OFFICE AND WORKS

WAYNESBORO, PA.

**Manufacturers of Refrigerating and Ice-Making Machinery**

CANADIAN REPRESENTATIVES

THE FRICK ICE & REFRIGERATION CO., MONTREAL, CANADA

BRANCH OFFICES

ATLANTA, GA.  
BALTIMORE, MD.

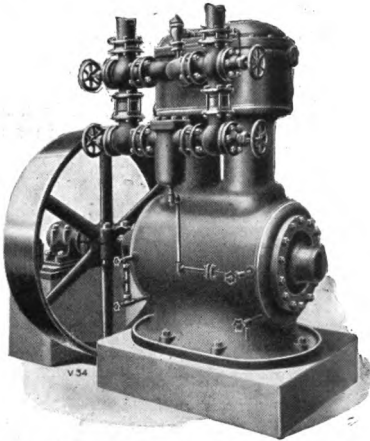
CHICAGO, ILL.  
DALLAS, TEXAS

NEW YORK, N. Y.  
PITTSBURGH, PA.

PHILADELPHIA, PA.  
ST. LOUIS, MO.

### PRODUCTS:

REFRIGERATING AND ICE-MAKING MACHINERY, AMMONIA AND CO<sub>2</sub> COMPRESSORS, AMMONIA CONDENSERS, AMMONIA COOLING COILS, BRINE COOLERS, CORLISS ENGINES, AMMONIA FITTINGS, AMMONIA PIPING, FREEZING SYSTEMS, NU-FRICK RAW WATER FREEZING SYSTEM, STEEL TANKS, BOILER SYSTEMS, WELDED DOUBLE COILS, ETC.

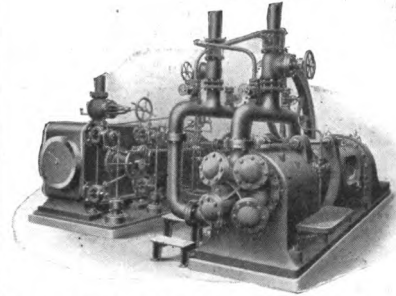


**Frick Enclosed Type Refrigerating Machine—**  
Arranged for Belt Drive

FRICK Machines and Equipment have been on the market for 38 years. They are used in all the varied industries requiring refrigeration for cooling purposes, for the conservation of food products, and for the manufacture of ice.

### TYPES OF MACHINES:

Vertical Single-Acting, Horizontal Double-Acting, Absorption. Adapted to any available power. Machines are built in units of size to suit requirements from  $\frac{1}{2}$  ton to 1,000 tons.



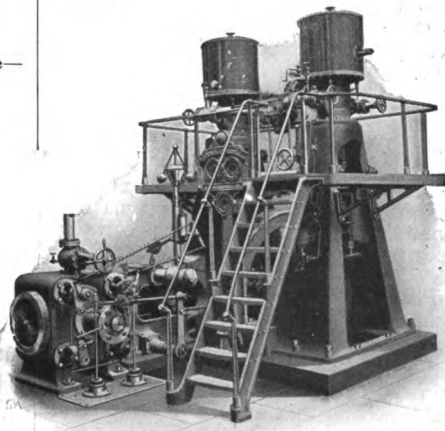
**Steam-Driven Ammonia Compressor—Medium**  
Size—Horizontal Type

### CATALOGUES:

Frick Machines and Equipment are described in detail in well-illustrated catalogues, which will be forwarded on **639** request.

### ESTIMATES:

A competent and well-equipped engineering department is maintained, and estimates on your requirements will be furnished on receipt of necessary information.



**Steam-Driven Ammonia Compressors—Medium**  
Size—Vertical Type

## YORK MANUFACTURING CO.

Ice Making and Refrigerating Machinery Exclusively

MAIN OFFICE AND WORKS:

YORK, PA.

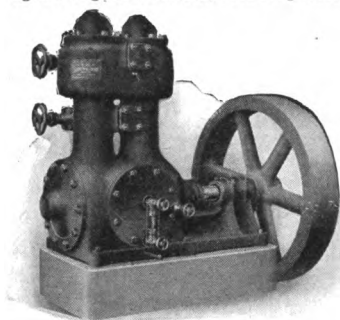
### BRANCH OFFICES

BOSTON, MASS., 88 Broad Street  
BROOKLYN, N. Y., Warren and Columbia Streets  
PHILADELPHIA, PA., 2222-24 Arch Street  
PITTSBURGH, PA., 47 Terminal Way, S. S.  
ATLANTA, GA., 116-18 Central Avenue  
CHICAGO, ILL., 26-28 North Clinton Street  
TORONTO, CAN., CANADIAN ICE MACHINE CO., LTD., 82 Chestnut Street

ST. LOUIS, MO., 117-19 South 11th Street  
OMAHA, NEBR., 1213-17 Jackson Street  
HOUSTON, TEX., Franklin Ave. and Louisiana St.  
LOS ANGELES, CAL., 308 Boyd Street  
SAN FRANCISCO, CAL., 832 Folsom Street  
SEATTLE, WASH., 508 Terry Avenue, N.

### PRODUCTS:

ICE MAKING and REFRIGERATING MACHINERY which includes: Compression Refrigerating Machines, Absorption Re-



640

Vertical Single Acting Enclosed Refrigerating Machine

refrigerating Machines, Ice Making Plants, Refrigerating Plants, Ammonia Valves, Ammonia Fittings, Ammonia Condensers, Brine Coolers, Aqua Ammonia Pumps, Ice Cans, and all parts needed to equip a complete ice making or refrigerating plant.

### DESCRIPTION:

We make, in our own factory, all the machinery and apparatus used in ice making and for general refrigeration, confining ourselves to the ammonia system, both compression and absorption types, and the CO<sub>2</sub> system.

### SIZES:

The enclosed machine is built in sizes from 1/8 ton refrigerating capacity upwards; the vertical single acting machines from 20 to 600 tons; the horizontal double acting machines from 10 to 600 tons—either belt or steam driven type. Ammonia absorption and carbonic anhydride (CO<sub>2</sub>) machinery of any capacity required by the trade.

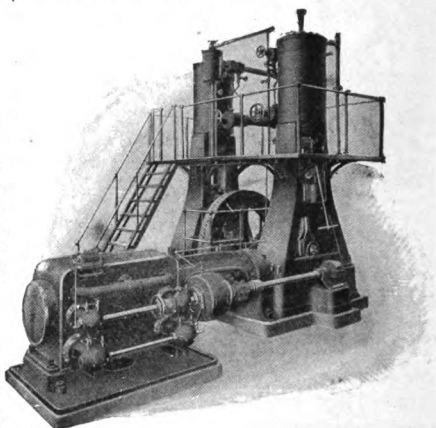
### APPLICATION:

These machines can be used wherever ice making or refrigeration is required, the style of machine being determined, to a great extent, by local conditions.

The enclosed machine is particularly adapted for residences, apartment houses, small hotels, creameries, ice cream factories, etc.

### VALVES AND FITTINGS:

York ammonia valves and fittings are guaranteed to give satisfaction under all usual working pressures.



Vertical Single Acting Refrigerating Machine Direct Connected to Uniflow Poppet Valve Engine

### SERVICE:

All York agencies carry in stock a complete line of ammonia valves and fittings, also a line of enclosed machines.

What a service department is to the owner of an automobile, the York Sales Organization is to the user of ice making and refrigerating machinery.

Both *quality* and *service* can be secured by patronizing the York Organization.

## AMERICAN TOOL & MACHINE CO.

Established 1843

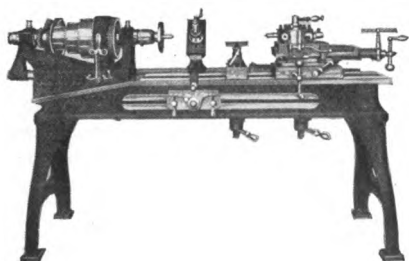
Incorporated 1884

BOSTON

### FOX BRASS FINISHERS' LATHES:

Patented and introduced in 1857.

14 styles and sizes.



A constantly increasing demand for more than sixty years.

### BELT KNIFE LEATHER SPLITTING MACHINE:

Splitting is the most profitable process in leather manufacture.

### FABRIC COATING MACHINES:

Spreaders—Doublers

### RUBBER CEMENT CHURNS:

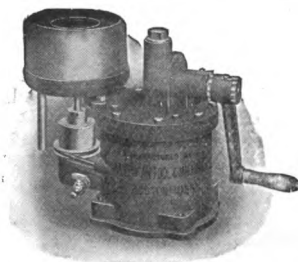
### POWER TRANSMISSION MACHINERY:

"AMERICAN" and "BOSTON" Hangers, superior in design, construction and operation.

Friction clutches and all specialties.

### WESTON CENTRIFUGALS:

Patented and introduced in 1866.



5 Inch Hand Power

First developed for sugar and modified to meet every demand requiring centrifugal process.

641

5 inch diameter hand power.

10 inch diameter belt or motor for laboratory.

30-36-40 inch for sugar and chemicals.

20 inch diameter drying small pieces and up to 54 inch diameter hydro extractor.

Various sizes for special products; bottom driven, top driven.

### ROPER CENTRIFUGAL OIL SEPARATOR:

For saving oil from chips and turnings.

Built for more than forty years with a larger demand than ever.

Engineers—Founders—Machinists

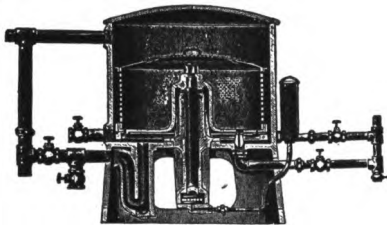
## THE OIL AND WASTE SAVING MACHINE COMPANY

1509 REAL ESTATE TRUST BLDG., PHILADELPHIA

**Manufacturers of Machinery for Separating and Reclaiming Oil and Waste, Centrifugal Oil Filters, Oil Extractors for Cleaning Oily Chips**

### IMPROVED WASTE MACHINE:

The basket or waste receptacle in the machine is driven by direct connected steam turbine, which exhausts into the basket, heating and liquefying the oil and grease, which is extracted from the waste, towels or rags by centrifugal force. The machine is then filled with water, and the waste, towels or rags thoroughly washed and sterilized, after which same is dried by the machine for future use.



642

Waste Machine

Guaranteed saving of 90% of the oil and all of the waste. Requires little attention. Over 3,000 machines in use. Made in 10", 15", 20" and 36" sizes with respective capacities of  $\frac{1}{2}$  cu. ft., 1 cu. ft., 2 cu. ft., and 8 cu. ft. of waste rags or machinery towels per charge.

### TURBINE CENTRIFUGAL SEPARATOR:

**For Extracting Oil from Metal Turnings.**

This Machine is steam turbine driven



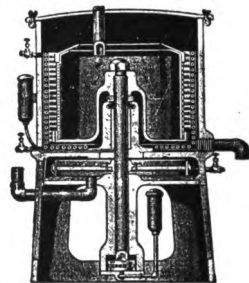
Turbine Centrifugal Separator

and the heat from the steam coming into contact with the oily chips and turnings aids the centrifugal action in producing an absolute oil extraction not procured with ordinary belt driven Separators. Machine can be operated with air. All belting and countershafting troubles and cares are entirely eliminated.

The Basket capacity of this Machine is 8 cu. ft., making it especially adaptable for the handling of long, curly and bushy turnings.

### TURBINE CENTRIFUGAL OIL FILTER:

Will remove all foreign matter, all moisture or emulsion from and sterilize the oil. Driven by direct connected steam turbine. The filter requires very little steam to operate same, owing to its design and its being equipped with a ball step-bearing; requires little care in operation and has practically no wearing parts.



Centrifugal Oil Filter

### SPECIFICATIONS

Size	15"	20"
Base measurements...	21"x21"	27"x27"
Height.....	30"	40"
Weight.....	450 lbs.	800 lbs.
Steam pressure required to operate...	20 lbs.	40 lbs.
Steam consumed per hour of operation...	83 lbs.	138 lbs.
Oil filtering capacity per hour.....	20 to 30 gals.	50 to 60 gals.

*Sugar Machinery, Air Compressors, Special Machinery*

# THE UNITED STATES AND CUBAN ALLIED WORKS ENGINEERING CORP'N

OWNING AND OPERATING:  
Krajewski—Pesant Corporation

Bradford Works  
Blaisdell Machinery Co.

Havana Dry Dock Co.  
Havana Iron Works

WORKS  
BRADFORD, PA.  
HAVANA, CUBA

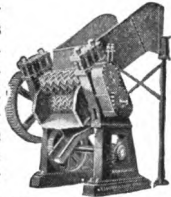
CABLES  
"IDOLWAX"  
NEW YORK & HAVANA

NEW YORK  
OFFICES  
50 BROAD STREET

**Machinery Manufacturers, Engineers and Contractors**

## SUGAR MACHINERY:

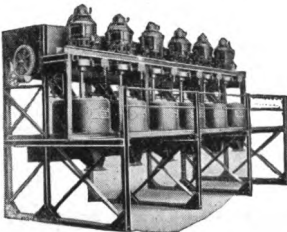
This corporation designs, manufactures and installs all varieties of the world-famous Krajewski sugar factory equipment, from separate parts to complete centrals, with sugar houses and all outlying buildings, including power plants; also complete beet sugar equipment.



Krajewski Crusher

## CENTRIFUGALS:

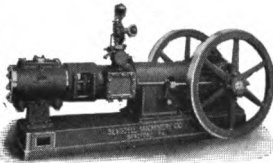
Our centrifugals, sugar or chemical, are rugged and durable in construction and simple in operation—belt, water or electric drive.



Battery of Six Centrifugals

## AIR COMPRESSORS:

Our long-recognized and established types and designs, for use in all branches of the mining and industrial fields, have won a deserved reputation.

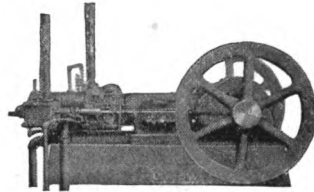


DN Steam Driven Compressor

## SPECIAL MACHINERY AND TOOLS:

We are equipped to furnish machine tool products from client's patterns,

special machinery of any description, or iron castings and pattern work for domestic or foreign use.

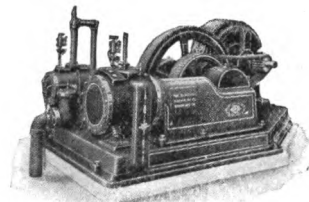


Gas Engine and Air Compressor

## ENGINEERING AND CONTRACTING:

643

An efficient engineering corps and long experience fit us especially well to undertake construction projects any place in the world in any field, including sanitation, water supply, terminal or water front improvements; also ship building and marine repair.



Class CN Heavy Compressor

## EXPORT SALES SERVICE:

We are exporters and direct sales agents of our own products to all countries, but also handle machinery and metal products for other concerns.

## INQUIRIES:

We invite inquiries from any part of the world respecting our lines. Prompt response will be made to all authentic requests for quotations, information and literature.

*Cold Rolling Machinery, Slitters*

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# THE BLAKE & JOHNSON COMPANY

Established 1849

MACHINERY DIVISION

WATERBURY, CONN.

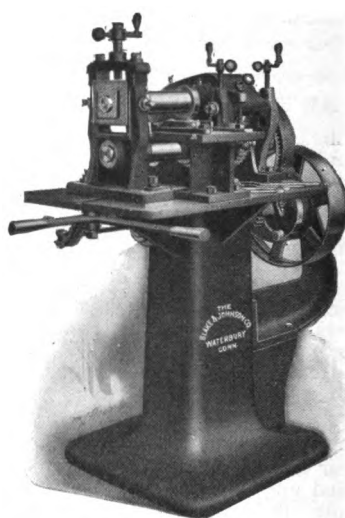
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**SPECIALISTS  
IN  
MACHINERY  
FOR  
MANUFACTURING  
METALS  
IN  
THIN GAUGES**

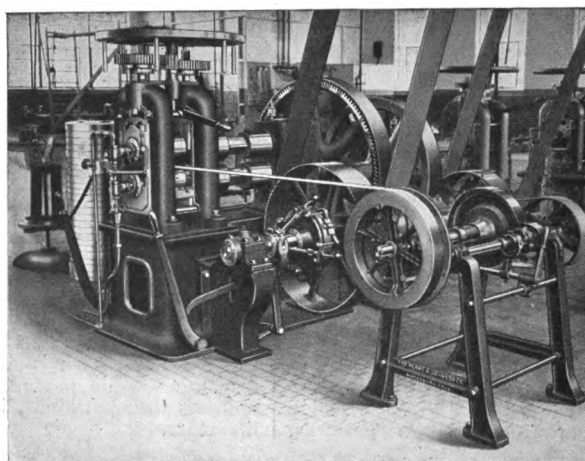
644

**COLD ROLLING MACHINERY**

**For Steel, Brass, Copper, Etc.**



**BUILDERS OF SLITTERS**



# THE TORRINGTON MFG. CO.

Incorporated 1885

TORRINGTON, CONN., U. S. A.

**Rolling Mill Machinery, Tube Drawing Machinery, Wire Drawing Apparatus, Cabling and Stranding Machinery, Special Machinery, Contract Work, Etc.**

## **ROLLING MILL MACHINERY:**

For brass, copper, aluminum, sterling and German silver, zinc, bronze, steel—or other cold rolling and finishing.

For sheets, strips or plates; also rods. Flatteners, straighteners, coilers, slitters, shears, drying machines, scouring machines, saws, mills, stretching machines, rolls, overhauling machines, mill trucks, blockers, etc.

## **TUBE DRAWING MACHINERY:**

For tubes and pipes of brass and copper or other ductile metals. Draw benches, straighteners, cutting-off saws, testing benches, pointers, die grinders, etc.

## **WIRE DRAWING MACHINERY:**

For wire and rods. Bull blocks, draw benches, air hoists, threshing barrels, die-stringing machines, continuous wire machines, fine wire machines, flat wire mills, trolley wire machines, rolls, straighteners,

spooling machines, magnet wire machines, pointers, etc.

## **CABLING AND STRANDING MACHINERY:**

For twisting or stranding individual wires into finished cables, electrical conductors and wire rope. Twisters, twinners, stranders, capstans, spoolers, take-ups, take-offs, etc. Machinery for cables **645** ranging from 2 to 91 wires.

## **SPECIAL MACHINERY FACILITIES:**

For satisfactorily producing special machines, from design to assembly. Drafting room, pattern shop, machine shop, forge shop. Screw machine, turret lathe and grinding departments. Buildings of modern construction. Exceptional attention to accuracy and privacy. Workmanship and material guaranteed.

## **CONTRACT AND JOBBING WORK:**

Of every description.

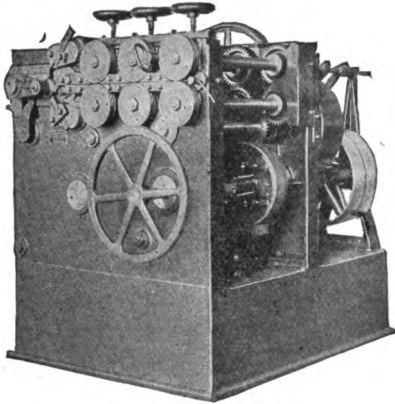
## SLEEPER & HARTLEY, INC.

WORCESTER, MASS.

COATICOOK, P. Q., CANADA

**Designers and Builders of High-Speed Automatic Wire Coiling Machinery**

### UNIVERSAL SPRING COILING MACHINES: (Patented)

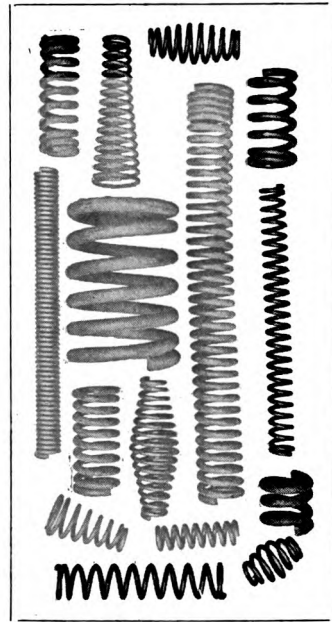


**646** Amongst the forty-odd, standard, spring makers' machines offered the trade for spring and wire coiling, spring setting, spring hooking, spring knotting, etc., the series of UNIVERSAL SPRING COILING MACHINES should be noted especially.

The machines of this type are designed to make complete, AND WITHOUT ANY TOOL CHARGE, all kinds of open-and-close-coiled wire springs. Right- or left-hand springs; straight, barrel-shaped, or tapered springs; springs with coned ends, or squared ends, can be produced.

The normal equipment of each machine is such that it will take, without change, all the wire sizes within its range; and will produce all the spring forms within its capacity, by merely shifting and adjusting the various working members.

These machines are now built in eight sizes, and are adapted to handle OIL



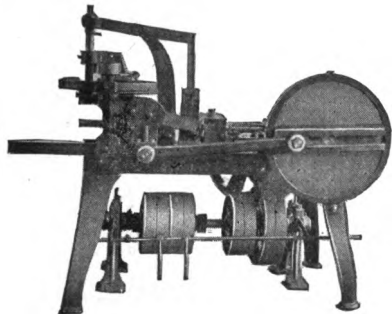
TEMPERED WIRE from .004" to  $\frac{5}{8}$ " diameter.

In addition to the machines described on these pages, we offer the following:  
HIGH SPEED WIRE STRAIGHTENING AND CUTTING MACHINES.  
MUSIC WIRE STRAIGHTENING AND BUNDLING MACHINES.  
TUNGSTEN FILAMENT COILING MACHINERY.  
FLEXIBLE SHAFT COILING MACHINES.  
FLEXIBLE CASING COILERS.  
FLEXIBLE METALLIC TUBE COILING MACHINES (IN 2 SIZES).  
DOUBLE POINT TACK MACHINES, ETC., ETC.



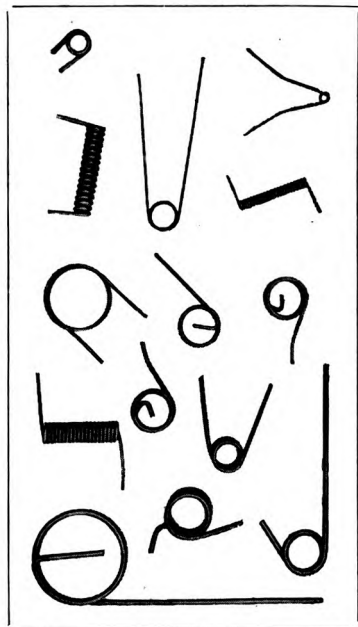
## SLEEPER & HARTLEY, INC.

### TORSION SPRING WINDING MACHINES: (Patented)



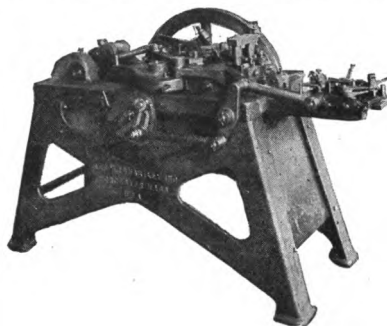
These machines are built in three sizes, handling OIL TEMPERED WIRE from .015" diameter to  $\frac{3}{8}$ " diameter.

These machines operate automatically.



Spring forms may be wound right or left hand, and the lengths and angular relations of the projecting ends may be varied as desired; one end may be put across the coil; and in some cases bends may be made in the projecting ends.

### WIRE NAIL MACHINES: (Patented)



These machines are a new development. Though small and compact, they are very powerful, the moving members operating in mechanical balance with ease and smoothness at exceptionally high speeds.

No rotating cams are used—all the working motions being accomplished by means of toggle joints—with a practically noiseless result. 647

The power is expended in making nails—not noise—and the consequent wear and tear upon the machine is enormously reduced.

The pointing and heading operations are separated, the heating effect upon the dies being thereby greatly reduced, and the working stresses much more widely distributed.

Other notable features are the accessibility of these dies, and the manner in which their adjustment is accomplished; compensating wedges are provided to take up wear throughout the machine.

These machines are built in five sizes, handling wire from No. 18 (.047") to  $\frac{3}{8}$ ", and making nails from  $\frac{3}{4}$ " to 10" in length.

*Weighing Machinery, Carton Sealing Machinery*

## AUTOMATIC WEIGHING MACHINE CO.

134-140 COMMERCE ST., NEWARK, N. J.

### BRANCH OFFICES

CHICAGO

PITTSBURGH

MEMPHIS

SAN FRANCISCO

HAVANA

LONDON

**Manufacturers of Automatic Machinery for Weighing, Packing, Sealing  
and Conveying Raw and Manufactured Products**

### APPLICATION:

Adapted to the use of manufacturers  
and packers of



648

**No. 515-A Bagging Scale**  
50 to 200 Lbs.  
5 to 6 Sacks Per Minute

Cottonseed

Cottonseed Meal

Powders

Chemicals

Tobacco

Cement

Sugar

Coffee

Spice

Washing Powder

Baking Powder

Starch

Seeds

Cereals

Grains

Flours

Wheat

Rolled Oats

Salt

Fertilizers

Clay

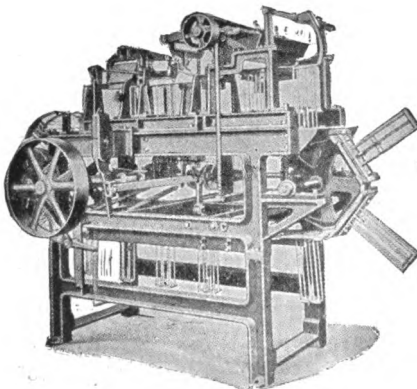
Limestone

Rock

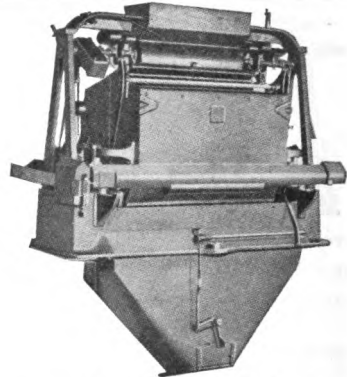
Clinker

Gypsum

Coal, etc.



**Bottom Carton Sealer No. 441**

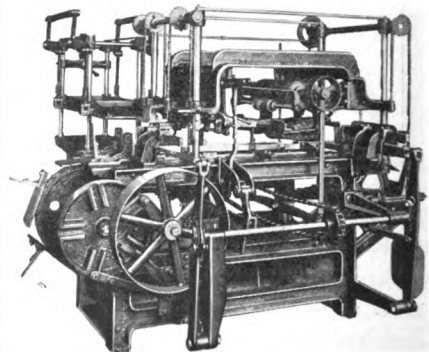


**Gravity Feed Machine**  
Types Range from  $\frac{1}{4}$  Bu. to 6 Bu.

Other models not shown on account of  
lack of space.

Write for Catalog.

We maintain an Engineering Department and will be glad to discuss your  
Weighing Problems.

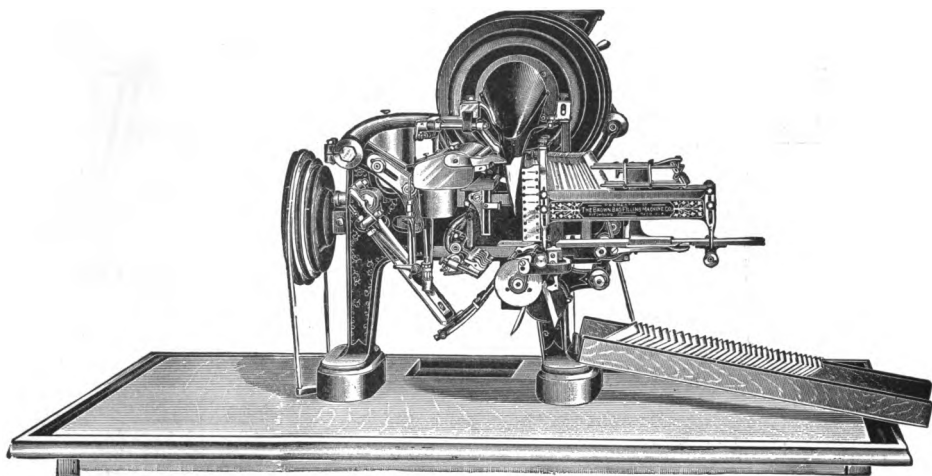


**Top Carton Sealer No. 451**

## BROWN BAG FILLING MACHINE CO.

FITCHBURG, MASS.

Designers and Builders of Bag Filling Machines, Bag Making Machines, Envelope Machines. Manufacturers of Screw Machine Products, Safety Rails for Bath, Tubs, Automobile Accessories



### THE BROWN BAG FILLING MACHINE:

This machine is used the world over for placing various commodities in sealed or open flat paper packets or bags. It will measure quantities from a few grains up to four ounces or, if desired, count a predetermined amount and seal in a container of flat bag form. It will handle powder or granular substance by weight, nails, screws, pills and tablets by count.

With this machine 3000 bags per hour can be filled and sealed, the contents being measured to weight or count.

### THE BROWN BAG MAKING MACHINE:

Users of this machine are assured that the bags made by it will be tight at the corners, perfectly uniform and true and without spoilage due to faulty machine

design. It is not limited to one size, and changes to another size may be made quickly and with a minimum of delay by means of duplicate parts. It is not necessary to have a machinist do this work, simply an intelligent adjuster. The parts are complete for each size.

One person can operate this machine and turn bags out at the rate of 6000 per hour.

### SERVICE:

We have a modern, thoroughly equipped machine shop where machines are manufactured, overhauled or rebuilt.

Our stock room can furnish you with any part of your machine which may have been accidently broken. As our machines are built with interchangeable parts, any part needed for replacement can be shipped immediately.

We maintain operating departments for both machines.

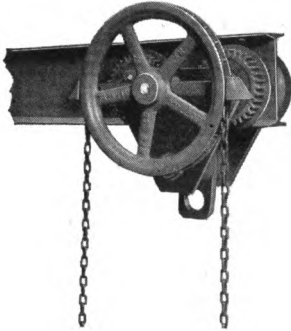
649

*Trolleys, Switches, Crushers, Etc.*

## FARNHAM MANUFACTURING CO.

31-39 INDIANA ST., BUFFALO, NEW YORK

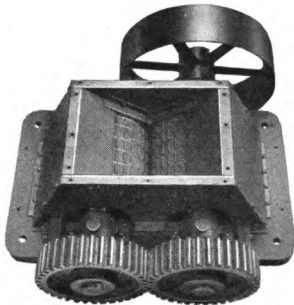
Manufacturers of Elevating, Conveying Machinery; Brass and Copper Mill Machinery; Trolleys, Switches, Turntables, Etc.; Paper Mill Specialties



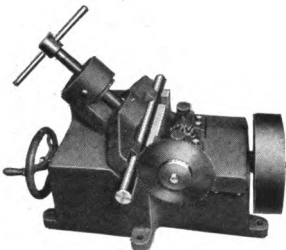
**PLAIN AND GEARED TROLLEYS**

Our trolleys are constructed of steel and are very strong and durable. Wheels are large in diameter and can be ordered to fit any size I-Beam.

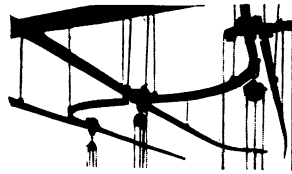
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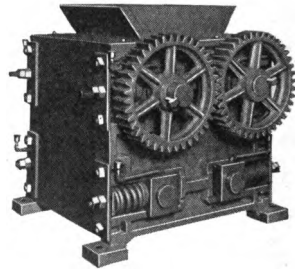
**TWO ROLL CRUSHERS FOR COAL, COKE, ETC.**



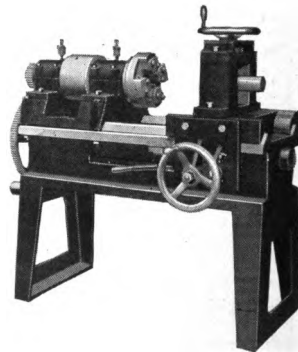
**TESTING SAWS**  
for testing Brass and Copper Rods.



**SWITCHES, TURNTABLES AND TROLLEY SYSTEMS**



**FOUR ROLL CRUSHERS FOR COAL, COKE, ETC.**



**ROD POINTING MACHINES**  
for pointing Brass and Copper Rods.

## NEW HAVEN SAND-BLAST CO.

NEW HAVEN, CONN.

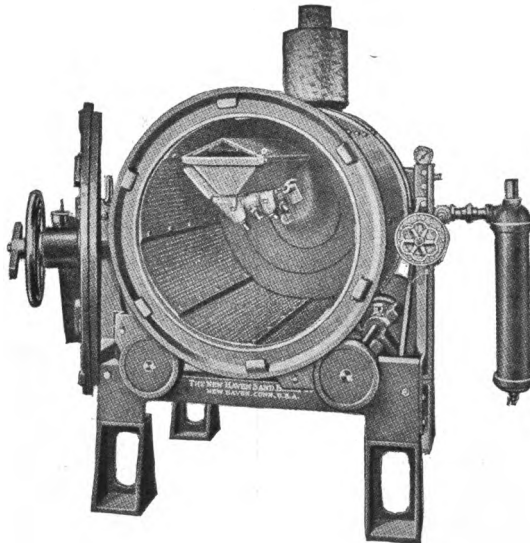
Manufacturers of Dreisbach Patent Sand-Blast Machines

### ARE YOU CONSIDERING SAND-BLAST?

If so, stop and consider the merit of construction before placing your order. The cost of maintenance after machine is installed is a very important factor and should not be overlooked.

employees are given a wholesome atmosphere to work in.

**CLEAN YOUR WORK FOR GALVANIZING** by sand-blast; you will obtain a cleaner and better surface than by any other method. Our barrel will do the



651

**The New Haven Self-Contained Sand-Blast Barrel** is the only barrel made that cleans the work, removes the dirt and recovers the sand to be used again all inside the barrel. This feature keeps the rollers, bearings, etc., away from the dust and dirt caused by the blast and avoids excess wear that increases costs and retards production.

**CLEAN YOUR FORGINGS** by sand-blast; it eliminates all the discomforts and expense of acid. The work is more satisfactory; your plant is clean and your

work of four or five men with scratch brushes, increasing your production and reducing your costs.

**CLEAN YOUR CASTINGS** by sand-blast; the same benefits are derived as from forgings. Do not stop to knock out cores by hand. **THE NEW HAVEN SELF-CONTAINED SAND-BLAST BARREL** will remove the cores and remove all dirt for you.

*Send for catalogue A. E. stating your requirements and we will be glad to give you the benefit of our experience.*

## PANGBORN CORPORATION

P. O. BOX 859, HAGERSTOWN, MD.

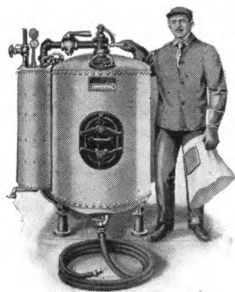
**Engineers, Designers and Manufacturers Exclusively of Sand-Blast and Allied Equipment**



The "Pangborn" line embracing, as it does, every practical system of sand-blasting, assures the user of counsel unbiased by limited designs and equipment. Hose Sand-Blasts, Sand-Blast Guns, Cabinet, Table and Barrel Sand-Blasts in single units or in combination and with specially designed rooms and ventilating systems to meet the individual conditions, cover every demand from the smallest to the largest.

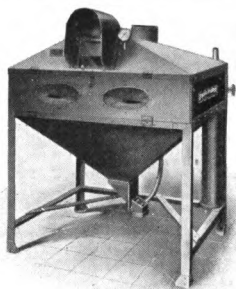
A corps of experienced Sand-Blast engineers study individual problems, assuring equipment and arrangement so necessary to economy of production. Detail of your needs and conditions will bring literature of adaptable equipment.

652



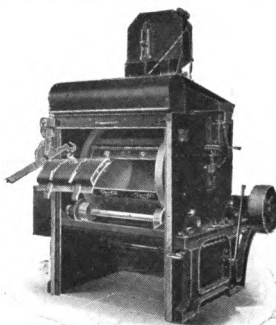
**Hose Sand-Blast**

**Hose Sand-Blast:** The Standard Direct Pressure Sand-Blast and the most effective of the various designs and types of Sand-Blast Equipment. Will do work possible with any type of sand-blast. It is particularly adapted to large pieces or extensive surfaces and work of a varied character. Made in several sizes and designs for installing either on the floor level, or in pit below the floor for continuous gravity feed. Also open hopper types for limited demands.



**Cabinet Sand-Blast**

**Cabinet Sand-Blast:** A self-contained Sand-Blast Machine of the continuous feed, suction type, occupying small space. It represents a complete Sand-Blast device at lowest first cost—Designed for small pieces, light work or small volume, "matte" finishing, frosting glass, etc., made in various designs with stationary and flexible nozzles.



**Barrel Sand-Blast**

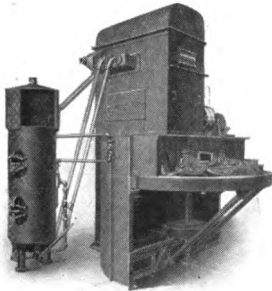
**Barrel Sand-Blast:** The most rapid and economical method of cleaning quantity production work too small for individual handling—Gravity feed, full value of air pressure. Self-contained, continuous feed, substantially built, requires no pit or foundation.

Will take pieces up to limit of door opening. Made in three sizes. Also in other types for smaller work.

## PANGBORN CORPORATION

### Revolving Table Sand-Blast:

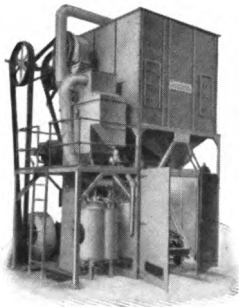
An automatic, self-contained, continuous feed, direct pressure, hygienic Sand-Blast for work of precision that would suffer from contact in handling, fragile castings or castings, forgings, etc., of odd or cumbersome shapes not adapt-



Revolving Table Sand-Blast

able to other methods of cleaning. Work loaded and unloaded as table revolves—Blasting takes place in enclosed chamber—Operator works in the open.

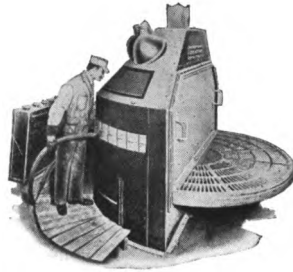
Made also in other types for crockery, glassware, etc.



Room Sand-Blast

**Room Sand-Blast:** A complete Sand-Blast Installation with direct pressure Hose machine (structural steel room)—Abrasive falls through grated floor to conveyor and elevator. Separator eliminates coarse and fine refuse from reusable abrasive. Ventilated to ten changes of air per minute. Dust confined in Cloth Screen Arrester. Equipment outside of room—controls within. Room can be equipped with bench, car

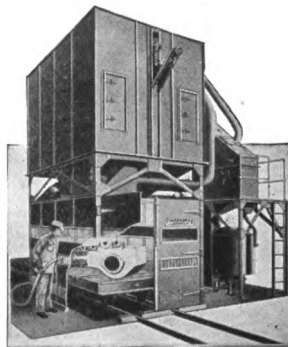
or monorail as required. Also constructed with rotative table in wall for loading and unloading work from outside.



"EH" Hygienic Table-Cabinet

**"EH" Hygienic Table-Cabinet:** A hygienic, semi-automatic direct pressure Sand-Blast Installation for work up to 3' 6" largest dimension. For use with Hose Machine placed either on floor level or in Pit beneath the Cabinet, for continuous operation. Pieces are loaded on the rear of rotative table, the partition of which entirely closes the Cabinet, the Operator working on the outside free from flying abrasive and dust.

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Hygienic Room Sand-Blast

**Hygienic Room Sand-Blast** for large work. Every efficiency of the Room Sand-Blast with the Operator relieved from all contact with dust-laden air. The last word in modern sand-blast application.

Built in size and arrangement to individual requirements.



## THE FROST MANUFACTURING CO.

Established 1851

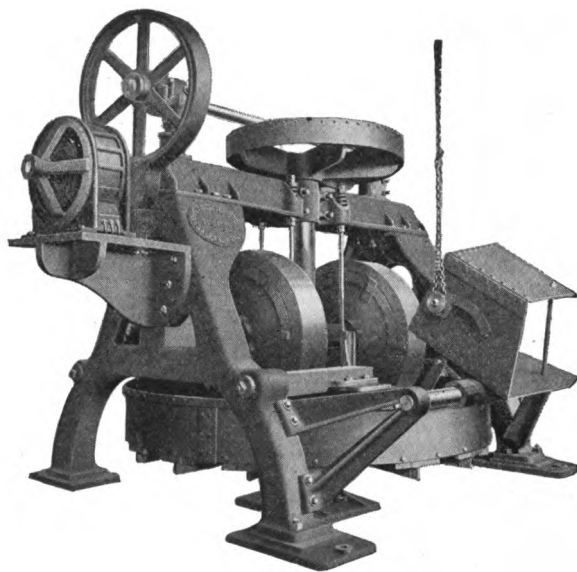
WORKS  
GALESBURG, ILL.

GENERAL SALES OFFICE  
112 W. ADAMS ST., CHICAGO

Manufacturers of the Frost Wet Pan for Steel Foundries, also Dry Pan for Clay Crushers

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***Frost***

### WET PAN SAND MILL:

For Preparing Sand  
for Foundry Mixtures.

This mill is made in sizes for capacities from  $\frac{1}{4}$  yard per batch to  $1\frac{1}{2}$  yards per batch. Has very heavy chilled mullers

racing on chilled grinding plates. The bucket unloader is operated by an air hoist controlled by one valve so that the operator is never in danger.

These machines are built in a most workmanlike manner, and are so designed that parts likely to wear can be readily replaced with a minimum of waste.



# THE E. J. WOODISON COMPANY

FACTORY AND HOME OFFICE, DETROIT, MICH.

\*Boston  
\*Buffalo  
\*Cleveland

Indianapolis  
\*Milwaukee, Wisc.  
Montreal  
\*St. Louis

\*Seattle  
\*Toronto  
Windsor

Fire Brick, Foundry Supplies and Equipment, Platers' and Polishers' Supplies and Equipment

We are both manufacturers and jobbers in our line and twenty-five years of experience enables us to give maximum service and value to our customers.

We carry large stocks at the above branches marked with a (\*) and are at all times best able to serve your needs.

A complete line of whatever you may require includes such items as

Crucibles

Chaplets

Chaplets (Perforated)

Compositions (Polishers)

Compositions (Parting)

Fire Brick

Foundry Facings

Foundry Supplies

Foundry Equipment

Machines, Molding

Machines, Core

Platers' Supplies

655

Platers' Equipment

Polishers' Equipment

Polishers' Supplies

Wax Vent

"Woodseed" Liquid Core Compound

In other words we are able to supply you with whatever you may need in the Foundry or Polishing and Plating departments.

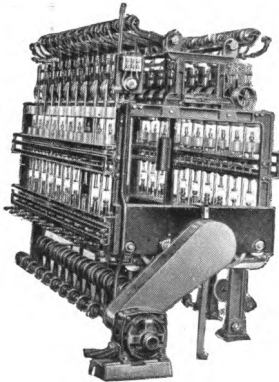
# AMERICAN INSULATING MACHINERY COMPANY

Established 1855

OFFICE AND WORKS

Incorporated 1915

FAIRHILL AND HUNTINGTON STREETS,  
PHILADELPHIA, PENNA., U. S. A.  
Manufacturers of Insulating and Special Machinery



Double Cover, Cotton or Silk  
INSULATING MACHINE

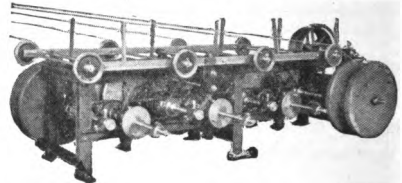
656

Wire Insulation Winding Machinery  
Wire Enameling Machines  
Wire Drawing Machines  
Wire Cabling and Stranding Machines  
Wire Respooling Machinery  
Rewinders  
Wire Bunching Machines  
Wire Measuring Machines  
Wire Pullout Capstans  
Saturating Tanks  
Rubber Covered Wire Panning Machines  
Rubber Covered Wire Vulcanizing Pans  
Rubber Covered Wire Patch Vulcanizers  
Reeling Stands with Traverse Motions  
Wire Twinning and Twisting Machinery  
Insulated Wire Reclaiming Machines  
Pressed Metal Reels for Wire, etc.  
Electric Railway Automatic Signals  
Remington Wrapping Machines

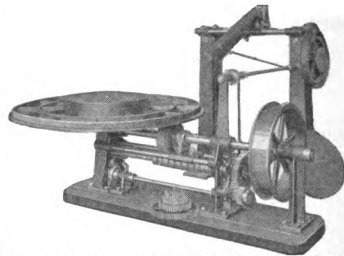
Special Machinery Designed or Built

EST. 1855  INC. 1915  
**"American"**  
**INSULATING**  
**MACHINERY**  
**COMPANY**  
REG. U.S. PAT. OFF.

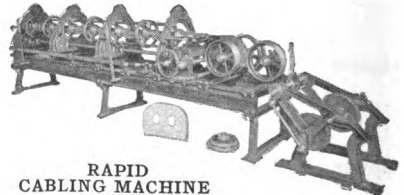
PHILADELPHIA  
PENNSYLVANIA U.S.A.



MULTIPLE PULL-OUT with Traverse  
for 8 Reels. Has 8 Independently Operated  
FRICTION CLUTCHES



"American-Seward" PANNING MACHINE  
for panning rubber covered wire in  
Pans 40", 48", 56", 60", 62" diameter



RAPID  
CABLING MACHINE  
Mounted on Ball-Bearings



ENAMELING MACHINE, Heavy Model  
for Wire 10 B. & S. to 20 B. & S. Gauge

## NEW ENGLAND BUTT COMPANY

PROVIDENCE, R. I.

European Agents: Selson Engineering Company, Ltd., LONDON, ENGLAND

**Manufacturers of Braiding Machinery; Machinery for Insulating Wires and Cables, also Machinery for the Manufacture of Wire Ropes and Cables**

### WIRE ROPE MACHINERY:

Full line of high speed and planetary type machines. Closing Machines for wire rope.

### BRAIDING MACHINERY:

Used for making plain and fancy braids for dress trimmings and millinery, round and flat shoe laces, soutache braids, candle wicking, tapes, cords, banding, clothes lines, fish lines, packing, gas tubing and rubber hose, round and flat elastic.

Sash Cord Braiders for making solid sash and curtain cord of various sizes.

Sash Cord Finishers for polishing solid sash cord.

Rubber Spreading Machines, built of any desired width for applying a thin coating of rubber to cloth.

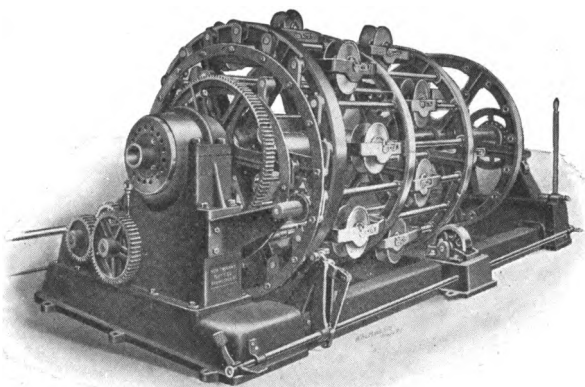
### INSULATING MACHINERY:

**Single, Double and Triple Deck Braiders:**

These are made in all sizes and combinations for covering wires from small sizes up to large cables.

Magnet Wire Machinery for silk and cotton covering arranged to handle round and flat wires.

Annunciator Wire Winders, Single, Double or Triple Deck.



Planetary Type Cabling Machine

657

Taping Machinery for taping wires or cables with paper or other materials.

Polishing Machines, for insulated wires and cables from the small sizes up to 3" cables.

Wire Measuring Machines.

Twinning Machines.

Rubber Strip Covering Machines, for applying rubber insulation to wires and cables with either single or double seam. These machines are built in several sizes and handle from one up to twenty wires at a time.

## NEW ENGLAND WIRE MACHINERY CO.

NEW HAVEN, CONN.

Manufacturers of Wire Stranding and Closing Machines, Insulated Cable and Wire Rope Machinery

Complete line of High Speed Wire Stranding Machines (Larmuths' Patent). These are high grade machines developed from long experience to meet the most exacting requirements, and producing a maximum output. Bobbin cradles or flyers and also the rollers supporting revolving frame are mounted on high grade ball bearings, also revolving frame and supporting rollers are carefully balanced to eliminate vibration when running at high speed.

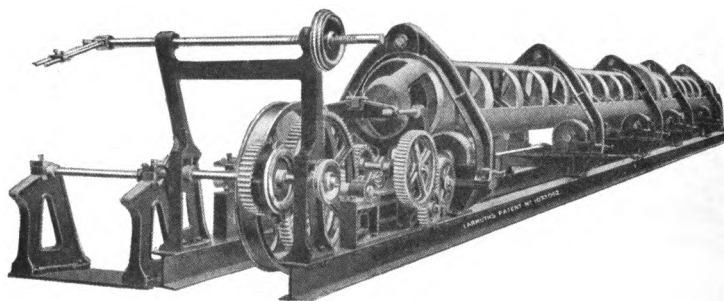
The illustration represents type of machines having bobbins  $6\frac{1}{2}$ " to 24" diameter, and for 3 to 19 wires. The drum stand for taking off the finished strand can be placed either at the side as shown or in front.

These machines are fitted with tight

machine by the draw-off capstan or both sections may be run as separate machines; the back section as a single machine with its own draw-off capstan and take-off reel at the side, and the front section with its own draw-off capstan and drum stand either at the side or in front as may be desired. Each section of these machines have their own driving pulleys, belt shifting gear and brake, the two sections being coupled together with one back shaft which is connected by cut gears in such a manner that the shaft does not act as a driver but only to keep the two sections running in unison at their relative speeds, and so prevent one overrunning the other.

Planetary Type Wire Stranding Machines for stranding any number or com-

658



and loose pulleys or can be arranged for direct motor drive. A suitable brake for quickly stopping the machine is fitted near head end.

These machines are also furnished in tandem, having 3 and 9, 7 and 12, or 9 and 15 bobbin sections, for bobbins  $6\frac{1}{2}$ " to 16" diameter. They are arranged so they may be run together in tandem, the strand from the back section passing through the front section as a core; wires from the front section being laid over this core in the same or opposite direction, the strand being drawn through the

bination of wires desired for wire rope or conductor cable.

Closing Machines for wire rope or conductor cable up to bobbins of 60" diameter.

Sector Conductor Stranding Machines.

Rubber Strip Covering Machines.

Measuring Machines.

Twinning Machines.

Bunching Machines.

Spooling or Bobbin Winding Machines.

Wire Tinning Equipment.

Complete plans and detail of equipment can be furnished for a given output of insulated cable or wire rope.

---

# TEXTILE MACHINE WORKS

READING, PA.

Manufacturers of Braiding and Insulating Machinery

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Manufacturers of

**BRAIDING MACHINES**

of all kinds

as well as other

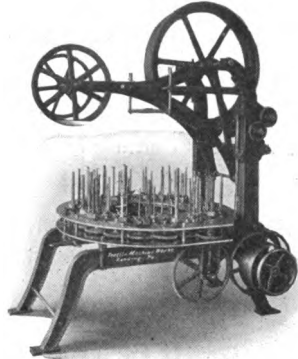
Machinery used in the

Braiding Industry

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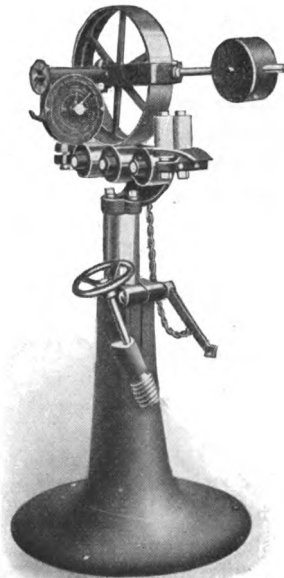
**HIGH GRADE**

**GRAY IRON CASTINGS**



Rubber Hose Braider

659



Measuring Machine for Wires and Cables

# THE DAVIS AND FURBER MACHINE CO.

NORTH ANDOVER, MASS.

Established 1832

Manufacturers of Textile Machinery and Card Clothing for Woolen and Worsted Mills

We have been making woolen mill machinery since 1832.

Our plant is the largest in its line in the United States.

Our machines are the standard for this country, and are continually being exported.

## LITERATURE:

Detailed catalogues and circulars are sent on request.

If interested in any of the list given here we should be glad to hear from you.

## PRODUCTS:

660

Card Clothing.

Carding Machines for Woolen, Worsted, Mohair, Asbestos, Cotton Waste, Flax Waste, Jute Waste, Silk Waste and Shoddy.

Garnet Breasts.

Condensers or Rubbs.

Card Clothing Grinding Machines.

Wool Pickers.

Wool Dusters.

Spinning Mules for Wool, Shoddy, Cotton Waste, etc.

Bobbin Winders.

Perches.

Dressers or Slashers.

Beamers.

Reels.

Spoolers.

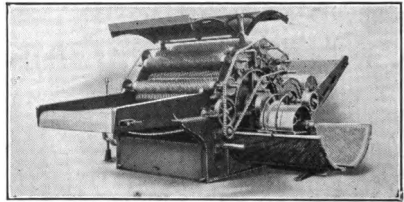
Skein Spoolers.

Skein Winders.

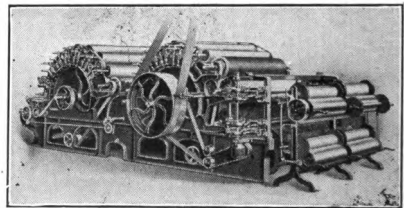
Twisters.

Chinchilla Machines.

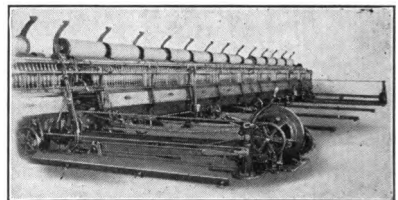
Napping Machines for Woolen, Cotton and Knit Goods.



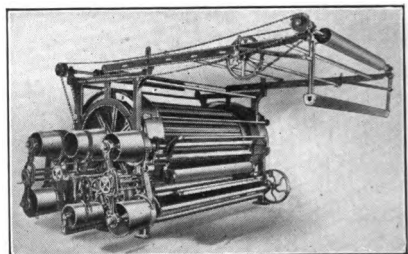
48" Fearnought Picker



60" Double Cylinder Card



360 Spindle Mule



36 Roll Napper

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# THE NATIONAL SUPPLY COMPANIES

PRINCIPAL OFFICES:

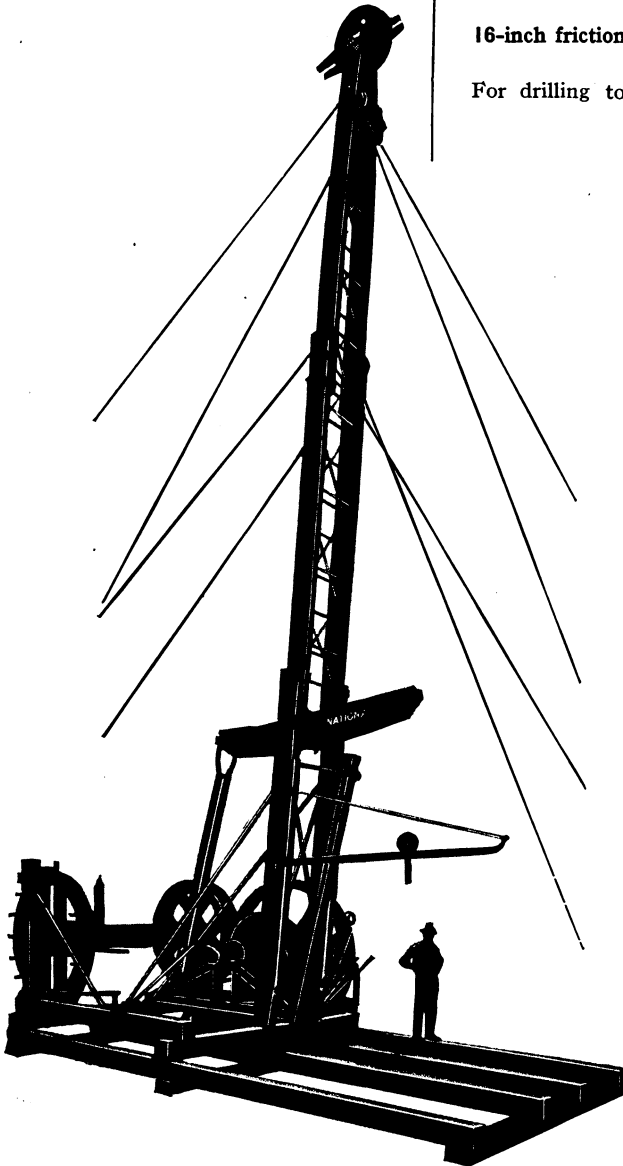
TOLEDO, OHIO

PITTSBURGH, PA.

INDEPENDENCE, KANSAS

---

## THE NATIONAL PORTABLE DRILLING RIG:



No. 2 (illustrated) heavy with steel frame, wood mast and bull wheels.

16-inch friction.

For drilling to a depth of 2500 feet.

For handling 1800 feet of 17-pound casing.

No. 1 for drilling 1600 feet and handling 1000 feet of 17-pound casing.

No. 3 all steel, portable for drilling to a 661 depth of 3000 feet, and for handling 1800 feet of 20-pound casing.

Special portable rig booklet furnished upon application.

---

Everything for the oil, gas and gasoline industry.

---

Pipe line and refinery supplies.

---

Branch stores in all the important oil fields in the United States, Canada and Mexico.

*Machinery, Tanks, Etc.*

---

## STEERE ENGINEERING CO.

DETROIT, MICH.

---



### **GAS ENGINEERS AND BUILDERS**

of

**Clean Producer Gas Plants**

**Coal Gas Plants**

**Public Utility Gas Plants**

**Direct Condensing and De-ammoniating  
662 Plants**

**Steere Electrical Detarring Process**

**Concrete Purifiers**

**Concrete Oil Storage Tanks**

**Gas Valves**

**Governors, Controls, Regulators**

**Welded Steel Pipe and Fittings**

**Doherty Washer Coolers**

**Tar Extractors, Multiple Washers**

**Condensers, Scrubbers and Grids**

**Tar Cameras for Colorimetric Tar De-  
termination**

**A Special Department for Expert  
Appraisal and Consultation.**

### **SHOP EQUIPMENT:**

**LATHES**—From 36 inches down.

**BORING MILLS**—Swing 7 feet, 48-  
inch and 38-inch clearance.

**PLANERS**—Largest 23-foot stroke,  
8 feet wide, clears 4 feet and down.

**ROTARY PLANER.**

**SHAPERS.**

**DRILLS**—From heavy radials down.

**ERECTING FLOOR**—31-foot clear-  
ance under cranes.

**PATTERN SHOP.**

**PLATE SHOP**—Equipped with most  
modern Tools.

**ELECTRIC WELDING**

We are in position to handle work com-  
plete through the drafting room, pattern  
shop, foundry, plate shop and machine  
shop.

### **WE DESIGN AND BUILD:**

**Special Machinery**

**Chemical Apparatus**

**Still, etc.**



## **WILCOX ENGINEERING CO., INC.**

SAGINAW, MICH.

**Manufacturers of Crystallizing Plants and Equipment**

### **PRODUCTS:**

Willcox Crystallizers and Grainers for salt, potash, saltpeter, and sodium nitrate.

Willcox Rakers for automatically and continuously delivering from the crystallizers as fast as the product is formed.

Willcox Automatic Conveyors for handling and distributing the crystalline material to a refinery mill or warehouse.

Willcox Bucket Elevators for handling salt, potash, or other crystalline material.

Willcox Liquid Weighing and Measuring Machine for automatically weighing and weighing water, caustic liquor, brine, etc.

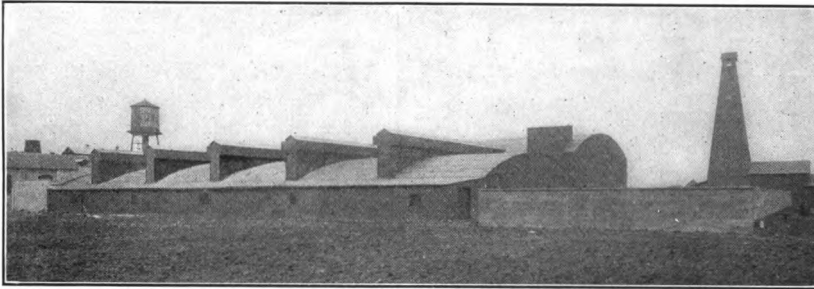
### **WILCOX AUTOMATIC LIQUID WEIGHER:**

This machine automatically weighs and records brine, caustic liquors, water of condensation from evaporators, boiler feed water.

It is a necessity in plants where a record of liquid measurements is desirable.

### **ENGINEERING SERVICE:**

Plans and specifications prepared for complete evaporating and crystallizing plants for the treatment of brine and its by-products, and consulting service in connection with the preliminary develop-



663

This salt plant, designed and equipped by Willcox Engineering Co., is almost automatic.

There are only two men on its payroll, one day-man and one night-man.

The plant has been in continuous operation for more than five years, producing about two hundred sixty barrels of salt per 24 hours from rather dilute brine obtained by pumping from a well 800 ft. deep.

The salt plant operates by exhaust steam from an adjoining manufacturing plant, the salt constituting a by-product of the exhaust steam.

The one-man crew carries out the following operations of the entire plant: Pumps the brine.

Treats it with lime.

Settles the brine for 48 hours.

Preheats it.

Evaporates it in three grainers or vats 150 ft. long by 12 ft. wide, equipped with Willcox patent submerged salt rakers which, with the system of automatic conveyors, delivers the salt commercially dry into the storage warehouse.

ment of proposed plants of this character constitute a valuable help to the clients of the Willcox Engineering Co.

The residual liquor from the grainers is drawn into a fourth grainer and further concentrated, producing ice cream salt and a concentrated mother liquor which is pumped to tank cars and sold to a chemical plant for the production of bromine and calcium-magnesium chloride.

All of the foregoing operations are carried out as before stated by a one-man crew.

The item of renewals and repairs and depreciation during five years of operation has been insignificant because of the durability and simplicity of design of the apparatus employed.

The above plant is typical of many such designs and installations that have been made by the Willcox Engineering Co. during nearly twenty years of practical experience in the design and operation of plants for the manufacture of salt and many other crystalline materials.

## THE SANDUSKY FOUNDRY & MACHINE CO.

SANDUSKY, OHIO

**Manufacturers of Fluid Compressed Non-ferrous Tubing and Special Paper Mill Machinery**

### FLUID COMPRESSED BRONZE TUBES:



664

are the product of a new patented process developed in our own bronze foundries.

The process involves the art of casting in permanent molds and compressing the metal while still in a fluid state.

The result is a casting free from blow holes, soft or hard spots, shrinkage cracks or other latent imperfections. The treatment gives the metal a close and homogeneous grain, a high and uniform density throughout the tube.

The machining is done on turning and boring equipments especially designed for the purpose.

**Range of Sizes:** 4" to 30" outside Diameter wall thickness from  $\frac{1}{4}$ " to  $1\frac{1}{2}$ " length up to 220" depending on Diameter and wall thickness.

**Chemical and Physical Properties:** Almost any non-ferrous composition may be furnished. A few compositions, much in demand, are:

**No. 1 Sandusky Standard:** 85% Cu, 6% Sn, 6% Zn, 3% Pb and Ni. Average ultimate tensile 40,000 lbs. per square inch. Average elongation in 2"—24%. Used for propeller shaft sleeves, liners, bushings, and roll covers. Well suited

for machining and shrinking on. Excellent wearing quality.

**Comp. "G" Navy Specif. 46M6a:** 88% Cu, 10% Sn, 2% Zn. Average ultimate tensile 41,000 lbs. per square inch. Average elongation in 2"—32%. A tough and hard mixture for sleeves, bearings and liners.

**No. 4-N Sandusky:** 88% Cu,  $6\frac{1}{2}$ % Sn, 1% Ni,  $4\frac{1}{2}$ % Zn and Pb. A splendid hydraulic composition used where tubes must stand high external or internal pressures.

**Naval Brass, Navy Specif. 46B10a:** 62% Cu, 37% Zn, 1% Sn. Average tensile 52,000 lbs. per square inch.

**Purposes:** Fluid compressed Tubing is successfully used and by virtue of its superior quality, preferred to tubular products made by other processes for the following purposes:

- Propeller Shaft Sleeves
- Rudder Stock Bushings
- Bearing Liners
- Roll Covers and Jackets
- Bushings
- Cylinder Liners for Pumps and Presses
- Recoil and Recuperative Cylinder Liners for Gun Carriages, Bronze Pipe, etc.

**Patterns Are Not Needed:** We do not supply rough castings. For more complete treatise on the subject of Fluid Compressed Tubing send for Bulletin No. 201.

### SPECIAL PULP AND PAPER MILL MACHINERY:

A few of the products made are:

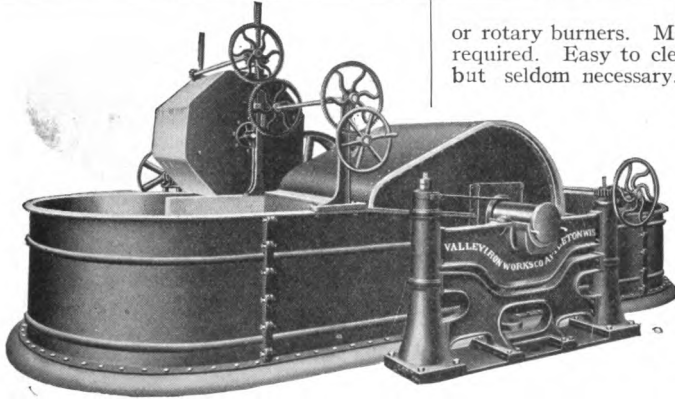
- Patented Suction Couch Rolls
- Suction Press Rolls
- Sandusky Shower Pipes
- Press and Breast Rolls covered with Fluid Compressed Jackets

Now standard equipment on all new modern Paper Machines.

## VALLEY IRON WORKS CO.

APPLETON, WIS.

**Builders of Beaters, Washers, Bleachers, Deckers, Sulphur Burners, Barkers, Shredders, Chippers, Wet Machines, Acid Tanks, Blow Pits, Stuff Chests, Centrifugal Pumps, Marine Engines**



or rotary burners. Minimum floor space required. Easy to clean when necessary, but seldom necessary. Results guaranteed. Correspondence solicited. Write for cuts and details. ■

### VALLEY IRON WORKS PUMPS:

For pumping Water, Paper Stock, and Acid. Built to fit exact conditions of

speed, head, and capacity. Adapted for continuous running with high efficiency.

### BEATERS:

Strong and reliable. Made right from the ground up. Washer gears and racks machine cut. Spindle support absolutely rigid. Long life and efficiency guaranteed.

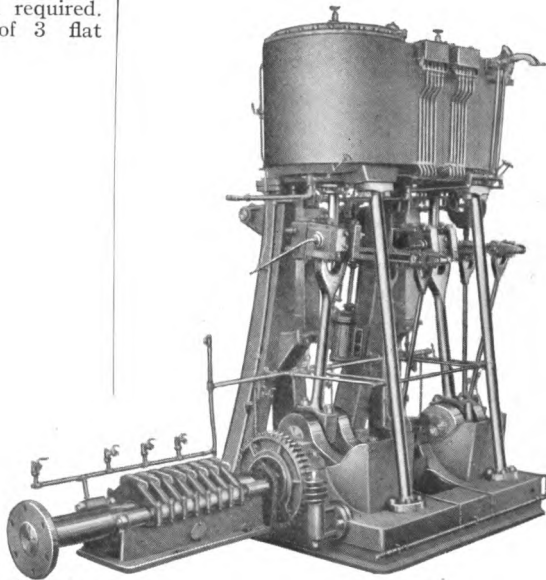
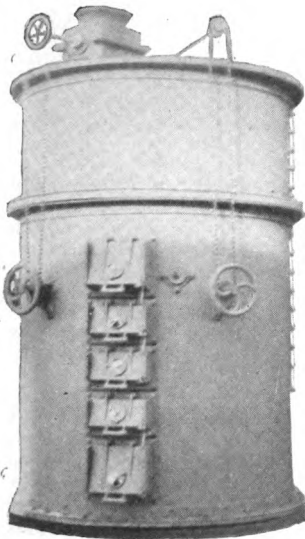
### VESUVIUS SULPHUR BURNERS:

Well constructed. Strong and substantial. No power or steam required. Self-contained. Does work of 3 flat

### MARINE ENGINES:

Approved by the Emergency Fleet Corporation. Built in sizes ranging from 450 horse power up.

665



## THE BIGGS BOILER WORKS CO.

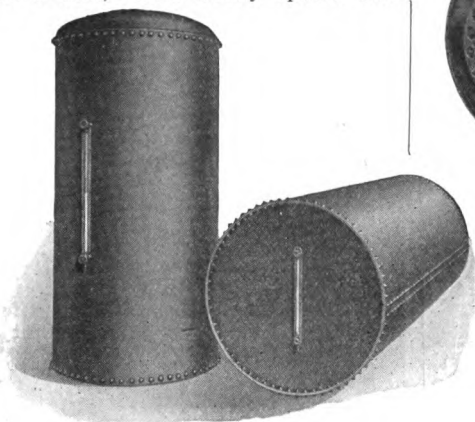
Established 1887

CASE AVE. & NEWTON ST., AKRON, OHIO

**Manufacturers of Steel Storage and Pressure Tanks of Every Description, Vulcanizers, Devulcanizers, Rotary Bleaching Boilers, Steel Riveted Pipe, Light and Heavy Plate Construction**

### PNEUMATIC WATER SUPPLY TANKS:

Our pneumatic water supply tanks are constructed throughout of soft open hearth steel, rivets closely spaced and



666

driven hot under hydraulic pressure, the heads being flanged and dished to a true radius of the shell. All openings  $1\frac{1}{4}$ " and larger are reinforced with pressed steel boiler flanges. The material and workmanship on these tanks are first class in every respect, and the tanks are guaranteed absolutely tight under initial test pressure of 150 lbs.

Tanks are furnished in sizes from 24" x 5', 117 gallons capacity, to 9' x 40', 19,000 gallons capacity. Standard sizes are carried in stock for immediate shipment.

Write for our Price List "F" covering our complete line of Pneumatic Water Supply Tanks, Air Receivers and Hot Water Supply Tanks.

### HIGH PRESSURE TANKS:

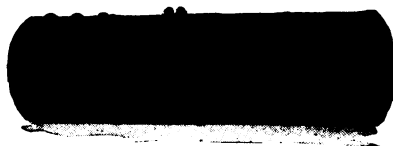
The accompanying illustration shows one of our heavy duty tanks designed for a working pressure of 500 lbs. per square inch, shell plates  $1\frac{1}{2}$ " in thickness and the rivets  $1\frac{1}{8}$ " in diameter. The longitudinal seams are butt joint quadruple staggered riveted with inside and outside covering straps. These tanks are largely used for gasoline reduction.



Owing to complete hydraulic equipment, we are prepared to furnish steel tank and plate work of the heaviest possible description, including Condensers, Evaporators, Filter Tanks, Surge Tanks, etc., etc.

### OIL AND GASOLINE STORAGE TANKS:

Our oil and gasoline storage tanks are constructed throughout of soft open hearth steel, rivets closely spaced and driven hot under hydraulic pressure. The heads of our storage tanks are flanged and dished to a true radius of the diameter the same as on the



pressure tanks, and each tank is thoroughly tested upon completion and guaranteed absolutely tight. Tanks are designed in accordance with Underwriter's specifications, and Underwriter's labels will be attached if so desired.

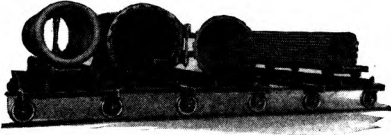
Tanks are furnished from 84 gallons capacity to 15,000 gallons. Standard sizes in stock for immediate shipment.

Write for Price List No. 25.

### VULCANIZERS FOR THE RUBBER TRADE:

Our vulcanizers are universally known and used exclusively in some of the large rubber plants. We equip our vulcanizers with what is known as our Simplex

## THE BIGGS BOILER WORKS CO.



Patented Quick Closing Vulcanizer Door, which is made throughout of cast steel, entirely self-contained, and opens and closes without the use of a bolt, nut, chain block or mechanical device of any description. In fact, all manual operations are practically eliminated, the opening and closing of the door being effected in less than thirty seconds.

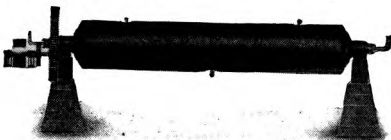
The construction of the door is such that it is practically indestructible, and it meets with the approval of the leading insurance companies and is acceptable to them for insurance.

We are prepared to furnish vulcanizers in all sizes from 24" to 84" in diameter, and any length and for any working pressure. The accompanying illustration shows our No. 800 equipment which is a 60" x 12' vulcanizer complete with inside track, outside transfer trucks, etc., designed for handling inner tube poles, wrapped tread casings, inner liners, etc.

Our Simplex door is also designed for attaching to old bolted style doors without removing the latter from the vulcanizer.

Write for Catalog No. 17 fully describing our general line of vulcanizers and equipment.

### DEVULCANIZERS AND MIXERS FOR THE RUBBER TRADE:



The accompanying illustration shows our standard horizontal rotary devulcanizers. These machines are furnished in practically any size required and are built for an operating pressure of 150 lbs. The shell is steam jacketed and properly stay bolted, the steam surrounding the entire jacket including both heads, and does not come in contact with

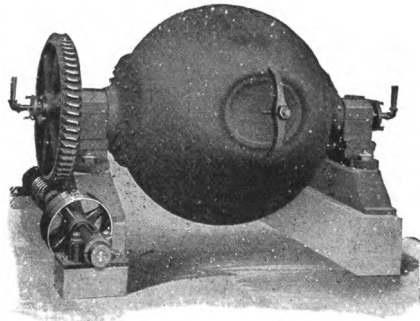
the rubber to be reclaimed that is placed in the inner chamber. The contents is continually agitated during devulcanization, as the machine rotates continually on heavy trunnions, to which is attached a standard train of driving gears as shown in illustration. We are also prepared to furnish stationary devulcanizers with agitating paddles both horizontal and vertical type.

### MIXERS:

Our mixers for the rubber trade, both single and multiple compartment, either rotate on trunnions or are furnished with agitators similar to the construction of the above devulcanizers, except that they are lighter with single shell construction.

### ROTARY BLEACHING BOILERS:

Our Rotary Bleaching Boilers are known throughout the United States and Canada, having installations in the leading paper mills. We furnish rotary bleaching boilers in both the Globe type as shown in the accompanying illustration, and the Cylinder type, having an assortment of standard drives for either type of bleaching boiler. The illustration shows a small experimental Globe, with a worm and worm wheel drive. Standard Globes are 14' in diameter, but we are prepared to furnish them in practically all sizes. 667



The Cylinders are usually furnished in from 7' to 8' diameter, 20' to 24' long. The spur gear drive meets with general approval on this type of boiler.

We recommend on the Globe type, our worm and segment gear drive. We have installations that have been in daily use for over twenty years, with the initial set of gearing still in use.

*Breechings, Stacks, Tanks*

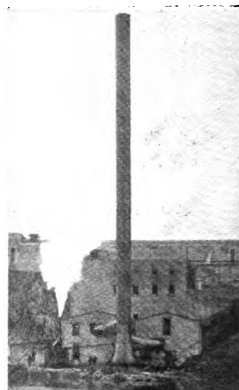
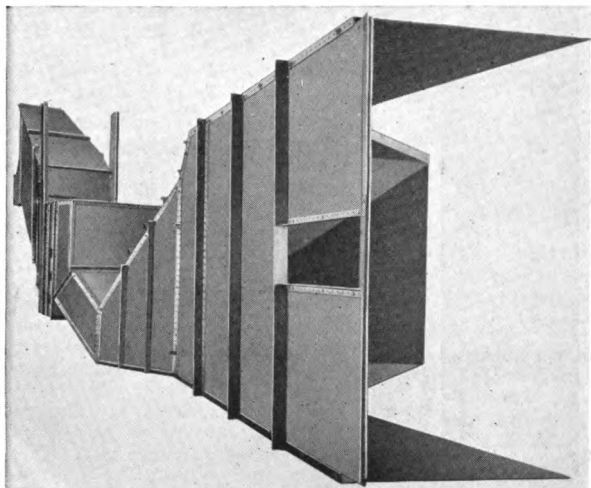
## CONNERY & COMPANY, INC.

2ND AND LUZERNE STS., PHILADELPHIA, PA.

NEW YORK OFFICE, 52 Vanderbilt Ave.

**Manufacturers and Erectors of Steel Plate Work of Every Description Including Steel Stacks, Stand Pipes, Boiler Breechings, Coal and Ash Hoppers, Tanks of Any Kind, Tar and Asphalt Kettles**

668



**Self-Supporting Steel Stack  
Manufactured and Erected  
for the Ehret Magnesia Mfg.  
Co., Port Kennedy, Pa.**

**Coal Hopper Manufactured and Erected for the  
Public Service Electric Co., Newark, N. J.  
Heavy Plate Work  $\frac{1}{4}$ " to  $\frac{3}{8}$ " Material**

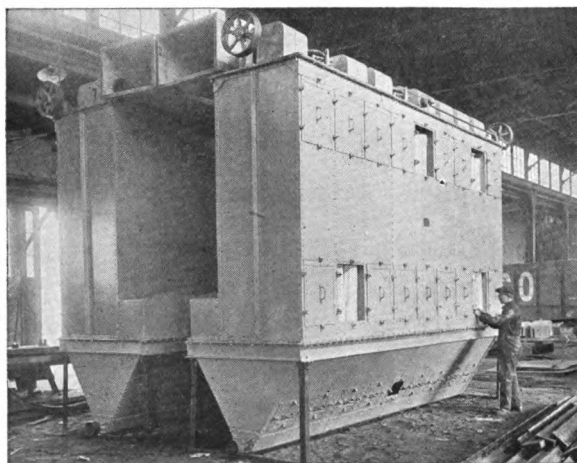
The reproductions shown, while of a character familiar to all engineers and about which little or no information need

be given, are typical of the general character and wide range of work handled by this company. We are equipped to fabricate and erect steel plate work of any description from  $\frac{1}{16}$ " to 1" in thickness.

Particular attention given to the most difficult construction.

Send us your plans and specifications for quotations or request

for information or assistance in connection with work in our line.



**Bag Washing Machine Showing Difficult Plate  
Construction, Light Plate Work  $\frac{1}{4}$ " Thickness**

## HENDRICK MANUFACTURING CO.

CARBONDALE, PENNA.

NEW YORK OFFICE: 30 CHURCH ST.

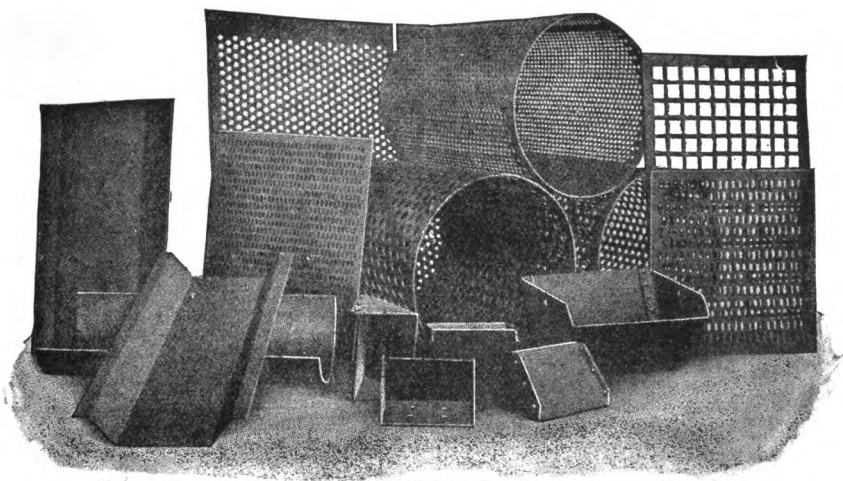
**Manufacturers of Perforated Metal Screens, Elevator Buckets, Conveyor Flights and Trough, Stacks, Tanks, Hoppers, Elevator Casings, General Sheet and Light Structural Work**

### **"HENDRICK" PERFORATED METAL SCREENS:**

In steel, bronze, copper, brass, lead and other metals for coal, coke, stone, ore and other materials requiring screening and cleaning.

**Exclusive Manufacturers of The Patent Flanged Lip Screen:** Used for screening coal and coke. The growing number of

In Our General Sheet and Structural Steel Department we make sheet steel work of every description, including Tanks, Hoppers, Coal and Ash Bunkers, Stacks, Smoke Flues, Elevator and Conveyor Casings, Screen Cases and General Sheet and Plate Pipe Construction. We are also prepared to fabricate Light Structural Steel Work, Chutes and Loading Booms for Tipples, Steel Truck



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users may be taken as an evidence of its efficiency. Fully described in our catalog which we shall be pleased to send you.

In Our Plate Department we build elevating and conveying equipment such as Elevator Buckets (plain and perforated), Conveyor Trough and Flights, also Pans for Scraper and Apron Conveyors, Picking Tables and Loading Booms.

Bodies, Mine Cars, Mine-Car Parts, Coal and Ash Conveying Lines and Heavy Buckets for the handling of ore and other materials.

We would be pleased to receive your orders or inquiries.

**WRITE FOR PERFORATED METAL HAND BOOK.**



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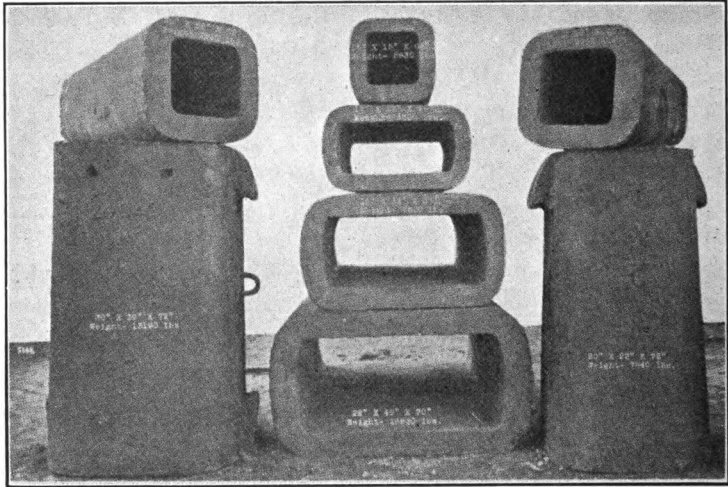
## THE MARSHALL FOUNDRY CO.

OFFICE: 1ST NAT'L BANK BLDG.,  
PITTSBURGH, PA.

WORKS: JOSEPHINE, PA., AND PITTSBURGH, PA.

**Ingot Molds and Gray Iron Castings**

---



670

### INGOT MOLDS

Made from direct furnace or remelted

*Standard Bessemer Pig Iron.*

CAPACITY 1000 TONS DAILY

ALL SHAPES

SQUARE      SLAB      OCTAGON

ROUND      CORRUGATED

ALSO SPECIAL SHAPES

We have Patterns for sizes used in  
general mill practice.

Gray Iron. Castings up to 100 tons in  
weight.

**Acid Stills**

**Blast Furnace and Rolling Mill Castings:**  
Bells, Hoppers, Hopper Extensions,

Hearth Jackets, Cooling Plates, Over-  
flow Troughs, Blow Pipes, Supply  
Pipes, Soaking Pit Covers, Charging  
Buggies, Ingot Cars, Gas Producers,  
Air and Gas Valves.

### Cast Iron Pots, Kettles, Etc.:

Cinder Pots, Slag Pots, Thimbles,  
Linings, Tinning Pots, Acid Pots,  
Chemical Pots, Paint and Varnish  
Pots, Salt Cake Kettles.

**Condensers**

**Evaporators**

**Filters**

**Glycerine Stills**

**Soap Stills**

**Structural Cast Iron:**

Columns, Bases, Post Caps, Floor  
Plates, Lintels, Guards, etc.



*Castings, Plate Work*

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# PHOENIX IRON WORKS CO.

Established 1865

MEADVILLE, PA.

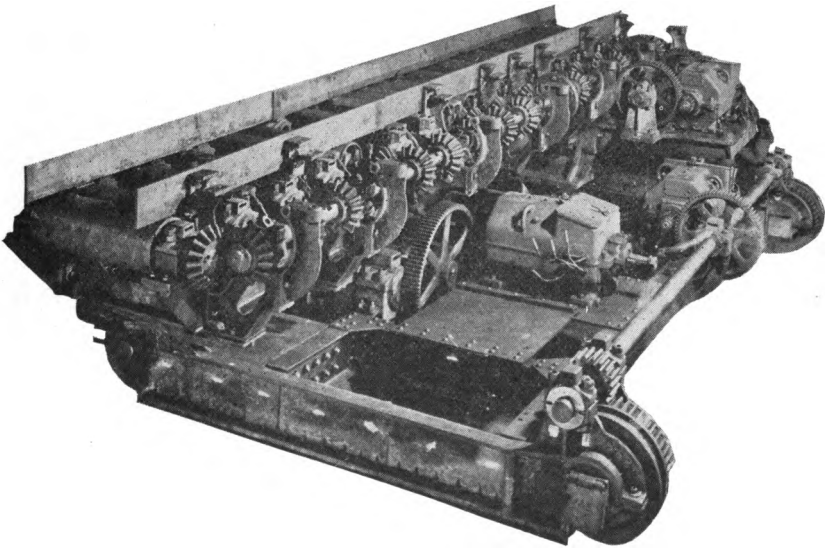
BRANCH SALES OFFICES

PHILADELPHIA, PA.  
710 Harrison Bldg.

NEW YORK, N. Y.  
619 Fifth Avenue Bldg.

PITTSBURGH, PA.  
601 Granite Bldg.

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671

Traveling Tilting Table

Manufacturers of:

**BOILERS**

**STACKS**

**BREECHINGS**

**TANKS**

**PLATE WORK—RIVETED &  
WELDED**

**LOCOMOTIVE CYLINDERS**

**IRON CASTINGS**

**ROLLING MILL MACHINERY A  
SPECIALTY**

**ENGINEERS & MACHINISTS**

*Inquiries  
Promptly  
Attended to*



# THE PETROLEUM IRON WORKS CO.

SHARON, PA.

NEW YORK

ST. LOUIS

SAN FRANCISCO, CAL.

The Petroleum Iron Works Company is located on a property of forty acres, situated about three miles south of Sharon, Pa.

Our railroad facilities here are excellent, as the works have direct connections with the New York Central, the Erie and the Pennsylvania Railway Systems. Our trackage for receiving and shipping inbound and outbound freight is more than a mile in length, thus affording ample space for car storage and ideal facilities for making shipments. Car shortages and delays occurring where there is but one railroad connection are practically unknown in this district. We, therefore, feel sure the trade will fully appreciate this condition, as it enables us to guarantee our promises of delivery to points in every direction.

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Our present plant consists of a substantial steel structure, fully equipped with modern machinery, tools and appliances, which insure accurate and rapid production. We are now in position to give our customers better satisfaction and more prompt service than ever before. Superior manufacturing facilities and careful shop inspection will continue to maintain our long-established reputation for high-class work.

The illustrations presented are shown merely as types of our various lines of work, among which we might enumerate the following:

Oil Storage Tanks (large and small)  
Acid Storage Tanks  
Water Tanks  
Water Softener Tanks  
Molasses Tanks  
Turpentine Storage Tanks  
Grain Tanks  
Tar Tanks  
Hydro-Pneumatic Tanks

Pressure Tanks  
Filter Tanks  
Car Tanks  
Portable Receiving Tanks  
Railroad Water Service Tanks  
Oil Refineries (complete)  
"Leman" Counter Current Condensers  
"Washington" Automatic Oil and Gas Separators  
"Gem" Fuel Oil Burners  
Riveted Steel Pipe  
Flumes  
Penstocks  
Blast Furnaces (complete)  
Converters  
Hot Metal Ladles  
O. H. Furnaces  
Pulp Digesters  
Galvanizing Kettles  
Creosoting Cylinders  
Condenser Boxes  
Coal Bins  
Steam Separators  
Air Receivers  
Water Towers  
Stand Pipes  
Smoke Stacks (Self-Supporting and Guyed)  
Breechings, etc., etc.

Special problems frequently arise which require the services of our Engineering Department. In order to assure prompt replies to inquiries, we request complete detailed information, including specifications and blue-prints when possible. Your inquiries and orders will receive the same prompt and careful attention which has made "P. I. W." service world-wide.

# THE PETROLEUM IRON WORKS CO.

SHARON, PA.

NEW YORK

St. Louis

SAN FRANCISCO

Oil Refineries—Complete

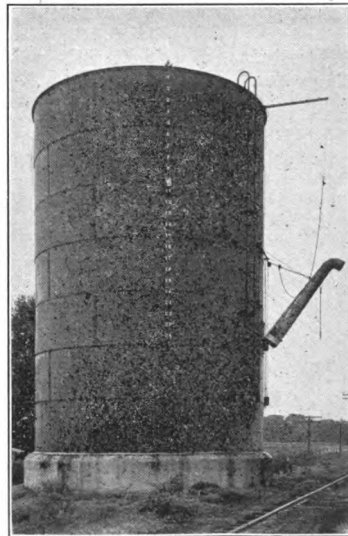


A 55,000 Bbl. Oil Storage Tank—One of a large group of tanks which P. I. W. erected for The Texas Company at their Port Arthur, Texas, refinery

673



150,000 Gallon Water Tower, Yonkers, N. Y.  
(Height over all 184')



R. R. Water Service Tank. Erected East Waco,  
Texas, for the "Cotton Belt"

## RIVERSIDE BOILER WORKS, INC.

Established 1889

CAMBRIDGE, MASS.

NEW YORK  
TRENTON

CHICAGO  
JACKSONVILLE

BOSTON  
DENVER

MONTREAL  
SAN FRANCISCO

NEW ORLEANS  
SALT LAKE CITY

Manufacturers of Steel Tanks



### TANKS MANUFACTURED:

Cylindrical Steel Tanks from 5 gals. to 2260 gals. capacity, with diameters ranging from 6 ins. to 48 ins. inclusive.

Pressure Tanks, for water or air, for all working pressures up to 200 lbs. inclusive.

Riveted and Brazed Tanks from 6 ins. diameter to 48 ins. diameter x 24 ft. long.

Welded Tanks from 6 ins. diameter to 48 ins. diameter x 24 ft. long inclusive.

674 Galvanized Tanks from 6 ins. diameter up to tanks 30 ins. diameter x 12 ft. long. Hot-dip process used.

Tanks made of stock varying from 14 gauge ( $\frac{5}{16}$  in.) to 3 gauge ( $\frac{1}{4}$  in.), with dished or flat heads from 14 gauge ( $\frac{5}{16}$  in.) to  $\frac{3}{8}$  in. inclusive.

Rectangular or odd-shaped tanks, riveted or welded, from  $\frac{1}{4}$  in. to  $\frac{1}{2}$  in. thickness inclusive, black or galvanized.

Kitchen Range Boilers, galvanized steel, riveted and brazed, in capacities from 12 gals. to 194 gals. inclusive, sizes from 10 ins. diameter x 3 ft. to 24 ins. diameter x 8 ft. Special designs in "Kopsteel" and "Armco Iron."

Expansion Tanks, galvanized steel, riveted and brazed, in capacities from 5 gals. to 120 gals. inclusive, sizes from 10 ins. diameter x 16 ins. long to 24 ins. diameter x 60 ins. long.

Barbers' Boilers, galvanized steel.

Hot water Storage Tanks, black or galvanized, with or without iron, brass or copper coils.

Pneumatic Water Supply Tanks, black or galvanized.

Air Tanks for fresh water supply systems.

Cistern Tanks.

Gasoline Storage Tanks.

Water Storage Tanks.

Fuel Oil Tanks.

Compressed Air Tanks.

Lubricating Oil Tanks.

Whistle Tanks.

Brine Tanks.

Rectangular Tanks to fit any location on shipboard.

Gasoline Storage Tanks.

Air Tanks for Garages.

Tanks for Chemical Manufacturers.

Compressed Air Tanks for all uses.

Tanks for use as floats.

Tanks for use with elevator installations.

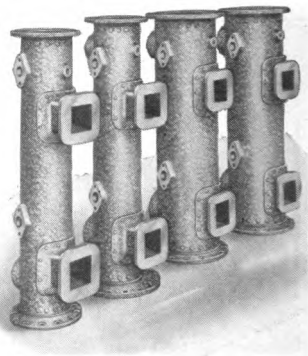
Tanks for drinking fountains.

Buoys.

Steel Sinks, black or galvanized.

Air tanks for spraying outfits.

Air Tanks for paint-gun use.



### WELDED HEADERS A SPECIALTY:

GALVANIZED STEEL WELDED HEADERS are far ahead of the cast-iron type. Built for high pressures.

## WM. B. SCAIFE & SONS CO.

Founded 1802

OAKMONT, PA.

NEW YORK OFFICE  
26 Cortlandt St.

PITTSBURGH OFFICE  
1st Nat'l Bank Bldg.

### Manufacturers of Scaife Copper-Brazed Pressure Tanks

#### BRAZED TANKS:

These tanks can be furnished of any diameter between 6" and 48", with one or both heads concave or convex.

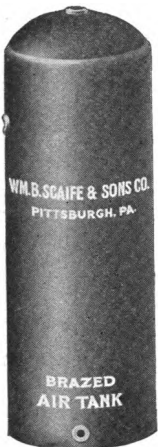


Plate H-8

fifty years. We positively guarantee these tanks to hold air indefinitely without loss of pressure.

Plates H-3 and H-4 are taken from actual photographs of a copper-brazed tank which we purposely tested to destruction. Notice the distorted shape of the bursted tank and the splendid condition of all the brazed parts, proving conclusively that they are stronger than the original material.

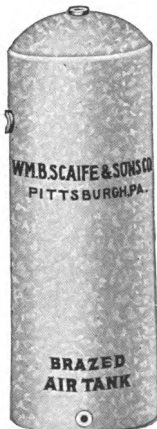


Plate H-9

Our exclusive process of copper-brazing the seams or joints makes these parts actually stronger than the remainder of the tanks. The brazing material so thoroughly unites itself with the steel, filling the minute interstices, that the tank has the strength of one continuous piece of metal. This copper-brazing process has been used by us exclusively for nearly

This tank was 12" diameter, shell  $\frac{7}{8}$ ", head  $\frac{3}{16}$ "; tensile strength of the steel, about 58,000 lbs. The tear in the shell occurred when the applied pressure reached 1,035 lbs. per sq. in.; all the brazed joints remaining intact.

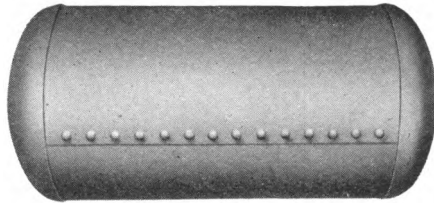


Plate H-3

Similar tests have been made frequently by entirely disinterested tank experts with the same results as in this case. 675

No other manufacturer furnishes copper-brazed tanks, although occasional attempts are made to create this impression in the public mind. Soft-soldering

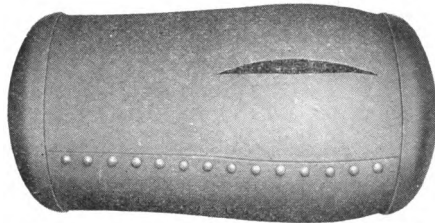


Plate H-4

and other so-called "brazing" methods must not be mistaken for copper-brazing. Hundreds of our brazed tanks made over twenty years ago are still in service. The copper coating around the seams protects these parts from corrosion.

*Brazed Pressure Tanks for All Purposes.*

*Also Welded or Riveted Tanks, Plain or Galvanized, for All Purposes.*

## THE H. B. SMITH CO.

WESTFIELD, MASS.

NEW YORK: 10 E. 39th Street

BOSTON: 138 Washington Street, North

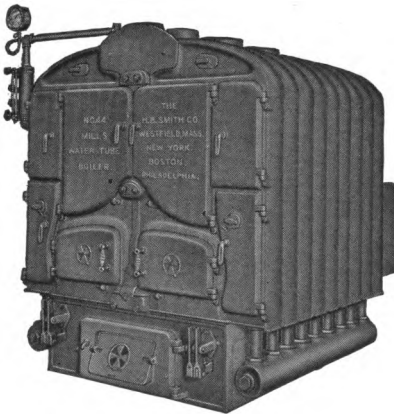
PHILADELPHIA: 17th and Arch Streets

**Manufacturers of Boilers and Radiators for Steam and Water Heating**

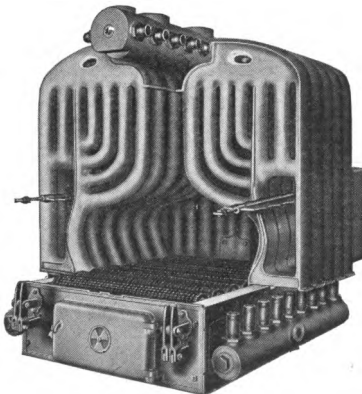
### MILLS WATER TUBE SECTIONAL BOILERS

*A. S. M. E. Standard*

676



No. 44 Mills Steam Boiler



No. 44 Mills Boiler—Interior

### MILLS WATER TUBE BOILER

Size of Boiler	Nominal Width Fire Pot	Commercial Rating Capacity in Sq. Ft.	
		Steam	Water
No. 24	24"	900 to 2025	1500 to 3350
No. 34	34"	2000 to 5200	3300 to 8575
No. 44	44"	3600 to 9000	5950 to 14850
No. 48	48"	4800 to 12000	7925 to 19800

MAXIMUM ALLOWABLE WORKING  
PRESSURE, A. S. M. E. STANDARD

In Lbs. per Sq. In.

Size of Boiler	Steam	Water (Open Tank)	Water (Closed Tank)
No. 24	15 lbs.	30 lbs.	15 lbs.
No. 34	15 lbs.	30 lbs.	15 lbs.
No. 44	15 lbs.	30 lbs.	15 lbs.
No. 48	15 lbs.	60 lbs.	30 lbs.

All of the water tube boilers listed on this page for water heating may be installed on pressures up to 60% greater than those shown in above schedule, but a special manufacturers' test will be required.

*Send for bulletins and catalogues giving complete information.*

# THE H. B. SMITH CO.

## SMITH SECTIONAL BOILERS: With or without Smokeless Furnace for Bituminous Coals STEAM

Size of Boiler	Width of Fire Pot	Rating Feet of Radiation	
		Without Smokeless Furnace	With Smokeless Furnace
No. 27	27"	1200-3900	1500-2900
No. 36	36"	2300-6800	2750-5400
No. 60	60"	6000-18000	6600-15600

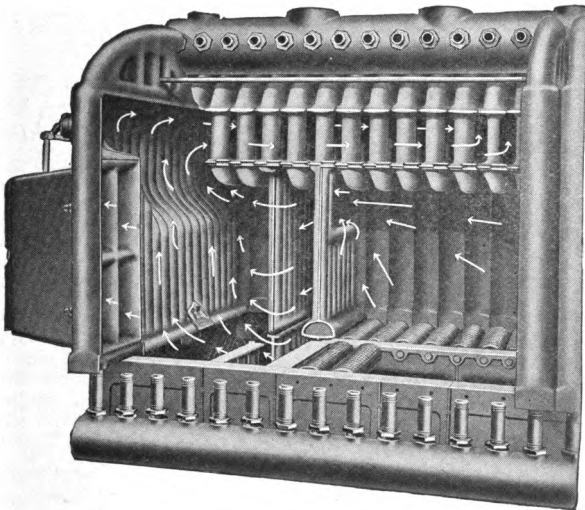
## SMITH SERVICE BOILER W-17:

For Hot Water Supply.

*A. S. M. E. Standard.*

Maximum Allowable Working Pressure

160 lbs. Open Tank; 80 lbs. Closed Tank.



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Smith Service Boiler W-17

## No. 60 Smith Boiler with Smokeless Furnace WATER

Size of Boiler	Width of Fire Pot	Rating Feet of Radiation	
		Without Smokeless Furnace	With Smokeless Furnace
No. 27	27"	1975-6425	2475-4775
No. 36	36"	3800-11225	4550-8900
No. 60	60"	9900-29700	10900-25750

Maximum allowable working pressure  
Lbs. per sq. in.

Size of Boiler Pot	Width of Fire Pot	Steam	Water (Open Tank)	Water (Closed Tank)
No. 27	27"	15 lbs.	30 lbs.	15 lbs.
No. 36	36"	15 lbs.	30 lbs.	15 lbs.
	60"	15 lbs.	30 lbs.	15 lbs.

Catalogs, bulletins and performance data of boilers will be sent upon request.

Send for Catalog No. 1146.

## PRINCESS DIRECT RADIATORS:

For Steam or Water Heating.

Test at ..... { One test 80 lbs. steam.  
Factory: ..... { Two tests 100 lbs. water.

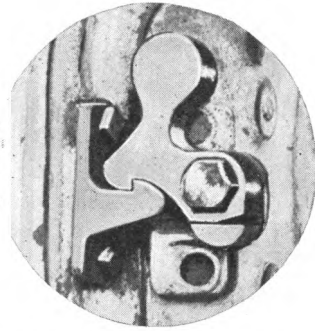
Made in single, two, three, five column and wall radiators.

Send for Radiator Catalogue No. 1010.

## THE DEWATERS SAFETY LATCH CO.

CENTRAL AVE., FAR ROCKAWAY, N. Y.

Safety Latches for Boiler Doors, Elevator Doors and other Openings



**THE DEWATERS SAFETY LATCH** was developed to protect firemen and other workers in boiler rooms, from injuries and fatalities due to live coals and steam being projected through furnace doors by backfire and boiler tube rupture.

678 In the last few years there has been a decided movement in this country toward better protection and safety conditions for workers and employees. The DeWaters Safety Latch is a response to this movement.

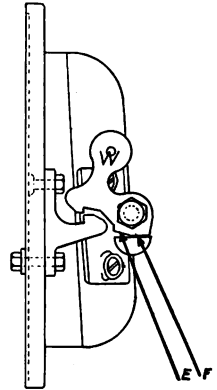
This safety latch was designed to meet the requirements of section 328 of the Boiler Code of the American Society of Mechanical Engineers, since generally adopted by state and municipal authorities.

The latch can be attached to any outward opening furnace door without change of design. It will give the protection to firemen of the inward opening furnace door and yet retain the convenience of the outward opening door.

The latch does not overheat so no other door handle is required. It will lock positively under all closing conditions, from a movement sufficient to carry the latch nose over the edge of the keeper to the most violent slamming.

DeWaters Safety Latches have been in constant service for two years or more and are as positive in their action as when installed, for there is practically no wear, the bevel stop faces receiving all impacts.

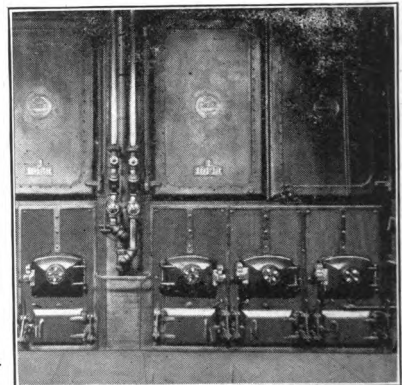
The DeWaters Safety Latch is always in a positive, ready-to-lock position. Its opening movement is limited by the bevel stop face F, to the amount required to clear the keeper. When released, it rests on bevel stop face E. The latch drops instantaneously into its locking position when the door is closed, locking before the rebound forces of the door can act. The rebound forces of the latch itself are taken up by the momentum and inertia of the weight W, the downward thrust and its design opposing all rebound.



The natural movement of opening the door by the latch handle unlocks the latch. The contact faces of the latch are generous, with strength beyond any demand, but it does not take undue space, or project inconveniently from the door.

The DeWaters Latch is applicable to elevators, firedoors and other openings; it is protected by United States and foreign patents.

*Illustrated pamphlet and list of users of this latch will be sent upon application.*





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# THE EDWARDS MANUFACTURING CO.

Incorporated 1901

306-336 EGGLESTON AVE., CINCINNATI, OHIO

## Manufacturers of Sheet Metal Building Material

NEW YORK, N. Y., 81-83 Fulton Street.  
PHILADELPHIA, PA., Land Title Building.  
DALLAS, TEXAS, 1635-37-39 Pacific Avenue.  
BOSTON, MASS., 6 Beacon Street.

PITTSBURGH, PA., 1405 Oliver Building.  
BALTIMORE, MD., Builders Exchange Building.  
LOS ANGELES, CAL., 1610 Fernando Street.  
DETROIT, MICH., Builders and Traders Exchange.

### AGENCIES

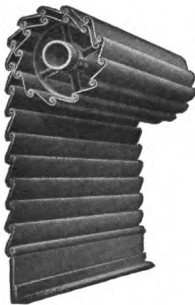
CHICAGO, ILL., 2847 West Lake Street.  
MINNEAPOLIS, MINN., Landons Hotel.  
SALT LAKE CITY, UTAH, 503 Dooley Building.  
HUNTINGTON, W. VA., Robson-Prichard Building.  
PORTLAND, OREGON, 313 Belmont Street.  
DAYTON, OHIO, Schwind Building.

SAN FRANCISCO, CAL., 1137 Mission Street.  
SEATTLE, WASH., 515 Bell Street.  
CLEVELAND, OHIO, 921 Citizens Building.  
INDIANAPOLIS, IND., 502 Chamber of Commerce.  
BIRMINGHAM, ALA., 1920 Third Ave.  
MILWAUKEE, WIS., 951 30th Street.

## EDWARDS ROLLING STEEL DOORS AND SHUTTERS:

Rolling Steel Doors have been designed by this Company's engineer, and successfully constructed for doorways of all sizes up to 40 feet in width, and for openings over 100 feet in height.

Rolling Shutters have been designed for windows and skylights. This Company is prepared to manufacture the combination complete, and with wire glass if desired. The rolling shutters are often operated in groups and sometimes by electric motors.



Section of  
Interlocking  
Slat

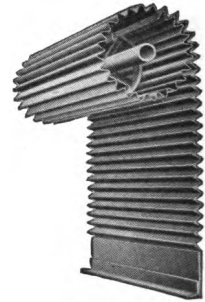
Edwards Interlocking Slat Style is constructed of special cold rolled strip steel 22 to 14 gauge; *bright or galvanized*; spring balanced; handle or chain operation.

This section of slat gives great resistance to wind pressure. It was purchased by the U. S. Government for many buildings in the Panama Canal.

Edwards Corrugated Style is constructed of the best sheet steel procurable for

this purpose; *black or galvanized*; spring balanced; handle or chain operation.

Our sheets have a special shape of corrugation and are fastened together without rivets.



Section of  
Corrugated  
Sheet

### USES: Specify Edwards Rolling Doors and Shutters for:

R. R. Shops  
R. R. Roundhouses  
R. R. Freight Sheds  
Express Buildings  
Steamship Docks  
Crain Elevators  
Telephone Exchanges  
Jails  
Banks  
Libraries  
Armories  
Gun Sheds  
Stairways, etc.  
Residences during closed seasons  
Federal, County and Municipal Buildings  
Office Buildings, Rear and Court Windows  
Dampers for Heating and Ventilating Systems  
Rolling Partitions for Churches and Schools  
Cotton Mills, Compresses and Warehouse

Post Offices  
Garages  
Car Houses  
Warehouses  
Factories  
Elevators  
Craneways  
Power Plants  
Boiler Fronts  
Transformers  
Subways  
Store Fronts

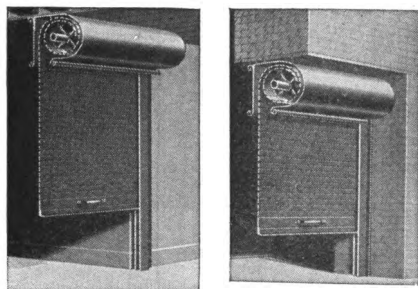
The benefit of forty-four years' experience is placed by our Engineering Department at your disposal.

Ask for catalogs and drawings.

# THE EDWARDS MANUFACTURING CO.

## STANDARD APPLICATIONS:

There are a great variety, because almost every building presents different conditions. A few are illustrated here.



Inside and Outside  
Handle Operated

## EQUIPMENT:

All Edwards rolling doors may be equipped, if so ordered, with:

(1) Patented Trolley Bridges, for car houses.

(2) Patented Wicket Doors, hinged to either side.

(3) Patented "Spring Release" mechanism, to cause door to close automatically in case of fire.

(4) Patented "No-key" padlock, either for hasp on bottom bar, or for operating chain.

(5) Patented electric motor operation or other special gearing.

(6) A combination or group operating mechanism. For example, to open and close car house doors in groups of two or more; to open and close craneway doors simultaneously in groups (such as designed by our engineer for The Panama Canal); double chain or crank gearing to operate door from both inside and outside of building.

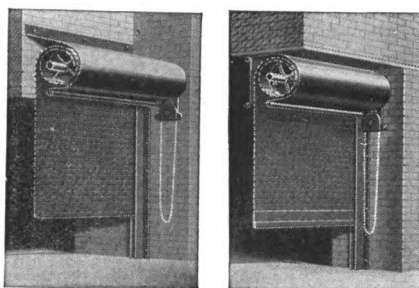
(7) Hinged or removable post, to swing up out of the way, or to be removed to a corner.

(8) Hoods, D-shaped or ornamental; necessary when doors coil outside.

## HOW TO SPECIFY:

"Edwards Rolling Doors of *Interlocking Steel Slat Style* (22, 20, 18, 16, or 14 gauge) bright (or galvanized), painted, and equipped with grooves and counterbalancing springs, enclosed and protected by hollow shafts. The coils to be covered by galvanized D-shaped hoods; all as arranged in Figures 1 to 11 (selected from opposite page). Fastened as shown on Architect's detail No. — to wood, steel, concrete or brick. To be erected by the manufacturer (or by the general contractor).

"Edwards Rolling Doors of *Corrugated Steel Sheets*, locked together without rivets, black (or galvanized), painted and equipped with grooves, counterbalancing springs enclosed and protected by hollow shafts, also galvanized D-shaped hoods to cover the coils; all as arranged in Figures 1 to 11 (selected from opposite page). Fastened as shown on Architect's detail No. — to wood, steel, concrete or brick. To be erected by the manufacturer (or by the general contractor)."



Heavy Rolling Steel Doors  
Chain Gear Operated

## SPECIAL DRAWINGS:

This organization will gladly prepare details and specifications for *all* types of doors and shutters, and so assist owner, architect or engineer to select the best and most economical installation.

## THE HASTINGS PAVEMENT CO.

EXECUTIVE OFFICES: 25 BROAD STREET, NEW YORK

PLANT: HASTINGS-ON-HUDSON, N. Y.

Manufacturers of Compressed Asphalt Paving Blocks and Tiles

### ASPHALT PAVING BLOCKS:

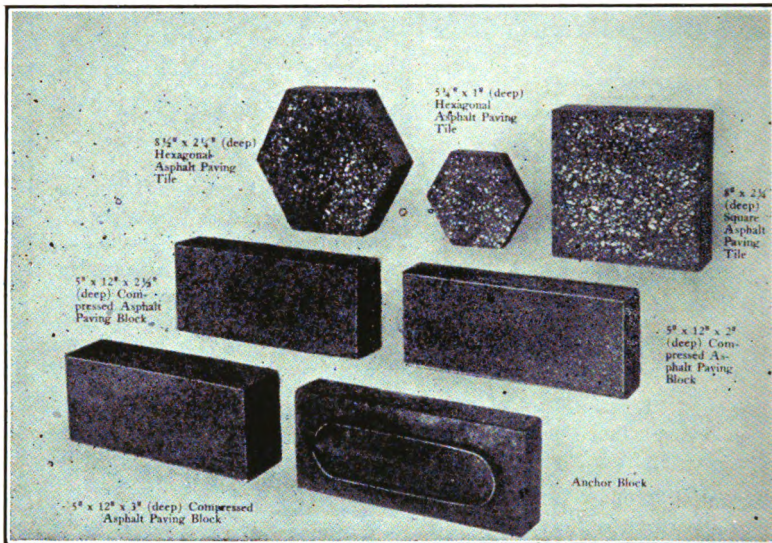
The logical material for the wearing surface of streets and roads, and of piers, warehouses, loading platforms, bridges, factory floors, driveways, courtyards, etc. Manufactured at a permanent plant; shipped in block form ready to lay; and always obtainable in any quantity for extension or repairs.

absorbent, and next to granite the most durable. Present a gritty, non-slippery, non-skidable surface. Easily taken up and relaid. Reasonable cost. Not affected by extremes of temperatures. Made to suit any climate and traffic conditions.

### ASPHALT TILES:

A wearing surface especially designed

682



### ASPHALT BLOCK FLOORS—THE MODERN FLOOR FOR HEAVY SERVICE

**Composition and Size.**—A properly proportioned mixture of natural asphalt, crushed rock and limestone dust is heated to 300 degrees Fahr., and shaped into uniform blocks under a pressure of 6000 pounds per square inch. The blocks are 5 inches wide, 12 inches long, and 2, 2 1/4 and 3 inches deep. Specific gravity, 2.40.

**Advantages.**—Asphalt block pavements are pleasing in appearance, smooth, noiseless, dustless, sanitary because non-

for sidewalks, and other surfaces subject to foot traffic. In the tiles, a selected white limestone is used for the mineral aggregate, instead of crushed rock, as used in the blocks.

### "EIGHTFOUR" ASPHALT FLOORING BLOCK:

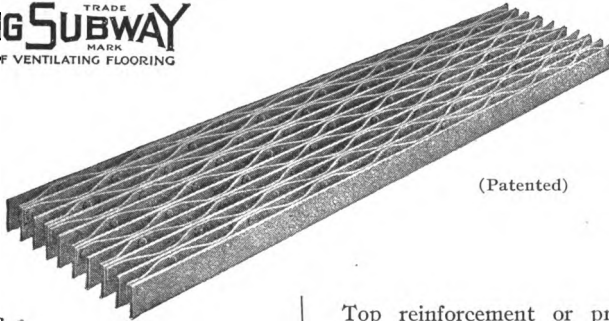
The "Eightfour" is designed especially to meet those conditions in which weight and depth of flooring are important considerations. Size 8" x 4" x 1 1/4". Weight 15 1/2 pounds per square foot,

# IRVING IRON WORKS COMPANY

THIRD STREET AND DUTCHKILL CREEK  
LONG ISLAND CITY, NEW YORK, U. S. A.

Telephone, Hunters Point 3342

**IRVING SUBWAY**  
TRADE MARK  
(PATENTED)  
THE FIREPROOF VENTILATING FLOORING



(Patented)

## PRODUCTS:

Sole manufacturers of Irving "Subway," the fireproof ventilating grating-flooring; "Reticuline," "Eggrate," and "Honeycomb" grating-flooring; other forms of grating-flooring and related products; metal accessories for power plants, lighting plants, dyehouses, chemical plants, industrial plants, steamships; stair treads, sidewalk doors, elevator gratings.

## TRADE MARKS:

The trade marks "Subway," "Reticuline," and "Sunway" are registered in the U. S. Patent Office, are the exclusive property of the Company, and cannot be legally used in connection with any grating-flooring products of any other manufacturer.

## SCOPE OF USE:

Irving "Subway" is a perfect fireproof ventilating flooring or grating-flooring, the exclusive advantages of which recommend it preëminently for such purposes as are here suggested, in all of which actual service has proved its superlative merit:

Power plant floors, galleries, walkways and stairs.

- Turbine pits.
- Pump platforms.
- Pipe trenches and sump covers.
- Storage rack shelving.
- Floors and walkways.
- Gas-house floors.
- Retort houses.
- Charging floors.
- Still houses.
- Replacing water-cooled plates.
- Register openings.
- Elevator and hatchway gratings.
- Ventilation shaft covers.
- Stair steps.
- Drying oven floors.
- Window guards.

Top reinforcement or protection for concrete floors.

## ADVANTAGES:

Irving "Subway," load for load and span for span, is the lightest grating-flooring made, and provides the maximum strength with the minimum addition to dead loads. Its construction gives a complete distribution of load over the full panel area.

Its surface is absolutely non-slipping under all conditions, and is safe and comfortable to walk upon. Wheeled trucks or rib-hooped barrels can be rolled over it in any direction without spreading the bars or going through.

It gives the maximum lighting and ventilation area, yet its individual openings are so small that only the smallest objects can pass through.

Its construction is strong, rigid and permanent. It cannot become loose and "rattley." Its appearance harmonizes with any surroundings.

Ordinary holes for pipes, columns, etc., can be cut out without additional framing or it can be built to fit irregular spaces. The structure of the flooring gives sufficient strength to carry the load.

## IRVING ENGINEERING SERVICE:

The Company's wide experience in applying Irving "Subway" for all purposes is available to all interested, without charge or obligation. Estimates will be furnished promptly, on receipt of rough sketch of lay-out, with spans and loads.

## CATALOGUE:

Catalogue 2A3, sent on request, gives complete description of Irving "Subway" grating-flooring, with specifications, tests, and loads and deflections for all standard sections.

*Reflectors, Sockets, Panel Boards, Signals, Etc.*

# BENJAMIN ELECTRIC MFG. CO.

NEW YORK  
243-247 W. 17th Street

CHICAGO  
806 Washington Boulevard

SAN FRANCISCO  
590 Howard Street



Benjamin Industrial Lighting  
Weatherproof Lighting Apparatus  
Gas and Vapor Proof Lighting Units  
Store and Office Lighting Fixtures  
Marine Lighting and Signal Apparatus  
Porcelain Enameled Reflectors and Specialties  
Two-Way Plugs  
Wiring Devices  
Electrical Specialties  
Industrial Signals  
Panel Boards and Cabinets  
Punch Press Efficiency and Safety Devices  
Castings in Aluminum, Brass and Alloys  
Drawings, Stampings and Spinnings in Sheet Metal  
Consulting and Engineering Service

684



Benjamin  
D o m e  
R e f l e c t o r  
R - L - M  
S t a n d a r d



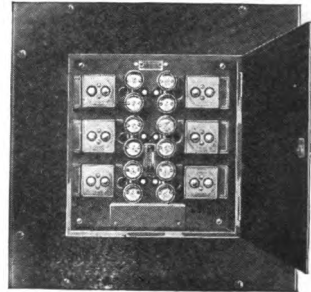
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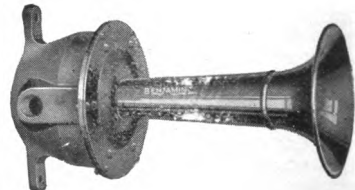
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H i g h V o l t a g e  
P u s h B u t t o n



Industrial Signal

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**DATA SECTION**  
**PART I**

**Data on**  
**A. S. M. E. Standards**

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**Pages 687-718**





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## I OUTLINE OF PROCEDURE IN CREATING STANDARDS

Soon after its foundation in 1880, The American Society of Mechanical Engineers instituted the procedure of creating standards of methods and dimensional standards and of issuing such standards in printed form for general use. To date upward of fifty such standards, or codes, have been formulated, and some of them have been widely adopted and have become the basis of extensive manufactures.

The consideration of a proposed standard by the Society has usually been inaugurated as the result of its attention being called to diversities of proportions existing in similar pieces produced by different manufacturers; variances in methods of measurement of similar quantities; lack of a uniform basis of expression of certain facts; absence of interchangeability, etc.

Sometimes the absence of the standard, and the consequent necessity of it, has been pointed out by a competent authority in a paper embodying a resolution recommending the expediency of the Society considering the matter and reporting. Sometimes an interested party has addressed the Society requesting an opinion, which has later been made the basis of a standard. Sometimes the Society itself has recognized the necessity for a uniform procedure and has taken the initial step toward its creation.

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In all cases, upon affirmative action by the Council of the Society, accepting the duty to formulate the standard, a committee of competent persons, members of the Society and other authorities, has been appointed to frame recommendations. Such committees have always been charged to take into their confidence all interested parties and to submit their findings to such parties for inspection and criticism before reporting them to the Society.

Reports of standards committees are presented at a general meeting of the Society and are, upon presentation, open for discussion by the whole membership and by others interested. Following such discussion, if, by vote, the recommendations still stand, the report is referred to the Council, who receive it and, upon approval by them, order it entered upon the record and printed in the *TRANSACTIONS* of the Society.

In cases where the field of action covered by a committee is very wide, viz., such as that of the Boiler Code Committee or the Power Test Committee, it has become the practice, on the acceptance of the committee's report and its subsequent discharge, to appoint a permanent committee to interpret the rules when called upon to do so, to make such revisions as may be found desirable, and to modify the rules to meet such new conditions as arise. These in-

terpretations and rules are formally approved at meetings of the permanent committee, and by letter ballot submitted to the members who could not attend the meeting. They are thereupon submitted to the Council, and if approved printed in *MECHANICAL ENGINEERING*, the journal of the Society. The permanent committee holds meetings from time to time at which all interested parties are given an opportunity to present suggestions with regard to the standards under consideration. These meetings constitute "revision periods" and take place at stated intervals, for instance, once in two or more years. All revisions of the codes or standards involving a change of meaning are reserved for these meetings, which may also take the character of "public hearings" so as to afford everybody interested an opportunity of stating his case in public.

Recent developments in the standardization work of the Society include the appointment, by amendment to the Constitution in the Spring of 1915, of the Standardization Committee as a standing committee of the Society. It is the function of this committee to standardize the method of making and arriving at standards rather than create standards themselves. This committee endeavors to bring about a unification of the standardizing work of the Society, and for this purpose national and international coöperation between organizations and governments, including an exchange of information with regard to standardization.

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Finally there is the Standardization Committee of the National Engineering Societies to coöperate by representation on a proposed Joint Committee composed of three representatives each from the national engineering societies, to consider and report back to their respective societies suggested means of bringing about coöperation in the formulation of American Engineering Standards.

The Society is at all times prepared to formulate standard within its field of activity and to assist other organizations in the preparation of standards, and will, upon request, appoint members to serve on committees for this purpose. Several such coöperative committees are at work at the present time.

In introducing the following summary of the work of the standards committees and abstracts of standards reports, it should be reiterated that none of the reports are adopted by the Society. They are simply actions which carry weight and a recommendation but no further obligation. In practically all cases the standards have been accepted by outside parties, but of course without request by the Society. That they have been so widely incorporated bespeaks a recognition of the authority, ability and judgment exercised by the committees responsible for them.

## II REVIEW OF THE WORK OF STANDARDS COMMITTEES

In this review of the activities to date of the professional committees of the Society in recommending standards, the material is grouped under the following principal heads:

- Testing Materials
- Boiler Specifications
- Power Tests
- Electrical Standards
- Flanges and Pipe Fittings, Screw Threads, Machine Screws
- Gages, Measuring and Recording Standards
- Safety Standards
- Miscellaneous

**Testing Materials.** In 1890 the Committee on Standard Tests and Methods of Testing Materials presented its first report on methods of conducting standard or scientific tests, in contradistinction to routine or shop tests. It also issued the results of certain international conferences on testing materials with recommendations as to their adoption and incorporation in American practice (Paper 380). The year previous, the committee's first official paper had been printed, being Appendix II to the 1890 report and comprising resolutions of international conferences on testing materials (Paper 378).

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In Papers 479 and 480 the committee recorded the proceedings of the third International Conference for the unification of standard methods of testing materials of construction held at Berlin in 1890. In Paper 550, of 1893, it urged the inauguration of international conferences for the unification of methods of testing, and also urged that the United States Government take cognizance of such conferences by the sending of duly accredited representatives.

In Paper 551, of 1893, were given the resolutions adopted by conferences at Munich, Dresden, Berlin, and Vienna, relative to uniform methods of procedure in testing building and structural materials. This paper supersedes Paper 378.

In Paper 654, of 1895, the committee took up the subject of standardization of castings and recorded the results of an investigation to show the relation between different sizes of castings poured from iron of a uniform composition; the chemical composition of each size of casting when cold, and also its physical properties.

In Paper 698, of 1896, were given the proceedings of the International Conference for the unification of methods of testing building and structural materials held at Zurich in 1895.

As a result of the formation of the American Society for Testing Materials, and its natural assumption of much of the work which this committee was doing and had planned to do, the latter did not present a final report, but the Society accepted each section and in 1900 discharged the committee.

The work has subsequently been carried on by the American Society for Testing Materials and by international congresses held from time to time, the first at Zurich in 1895, the second at Stockholm in 1897, the third at Budapest in 1901, the fourth at Brussels in 1906, the fifth at Copenhagen in 1909, and

## DATA ON A. S. M. E. STANDARDS

the sixth at New York in 1912; the seventh, which was to have been held at Petrograd in 1915, has been indefinitely postponed.

**Boiler Specifications.** In the matter of boiler specifications, the first report was that of the Committee on Specifications for Boiler Plate, Rivet Steel, Steel Castings and Steel Forgings, which was made in 1903. (Papers 979 and 1026.) This report was only tentative, however, because of the formation at that time of the American Society for Testing Materials, which relieved the Society of much work on standardization of materials.

In September 1911 the Boiler Code Committee was appointed to formulate standard specifications for the construction of steam boilers and other pressure vessels and for their care in service. This committee completed a preliminary report in 1913, which was sent out to boiler manufacturers for inspection and criticism before the presentation of final recommendations to the Society. Subsequently a draft report was printed and again subjected to severe criticism, in addition to a large amount of personal work being put into it by the individual members of the committee. Over forty organizations in all parts of the United States coöperated in this work by giving helpful suggestions or criticism.

The Boiler Code was discussed at Chicago in 1914, and again at the St. Paul-Minneapolis meeting in the same year. The discussion extended through six sessions of the Annual Meeting in New York in 1914, when the Boiler Code Committee presented its final report (Paper 1469).

The Boiler Code covers both new and existing installations, and deals with power boilers and heating boilers. Particulars are given in Paper 1469.

692 The Report recommended the appointment of a permanent committee to make such revisions of the rules as might be found desirable, and to modify them as the state of the art advanced, and that such committee should hold meetings at least once in two years, at which all interested parties might be heard. This recommendation was approved by the Council and the Committee accordingly appointed.

By Rules 331-4 of the Code, an official symbol or stamp (an enclosed "S") is to be used by the manufacturers to indicate that the Boiler Code Rules have been complied with in every detail in the construction of each boiler stamped with the symbol.

The American Uniform Boiler Code Congress assembled in Washington, D. C., December 1916, passed a resolution recommending that all states adopt it as standard, thus bringing standards, free interchangeability of boilers and efficiency together, to the end that manufacturers, users and inspectors might profit by the advantages of uniformity.

The first public hearing on the Boiler Code was held in December 1916 in the Engineering Societies Building and proved of unusual interest.

The Boiler Code Committee has held monthly meetings at which interpretations have been formulated for the cases presented to it for consideration. About 200 cases have been acted upon. During the past year the committee has engaged in extensive investigations in connection with a thorough revision of the Code and it is expected that a new edition will shortly be issued. A new locomotive-boiler section has been prepared by the Locomotive Sub-Committee and the subject of boiler inspection rules is also being considered.

**Power Tests.** In 1884 a Committee on Standard Methods of Steam-Boiler Trials presented its report. This was discussed at Atlantic City in 1885 (Paper 168) and is known as the Code of 1885.

The object of a steam-boiler trial was taken to be the determination of the quantity of steam that a boiler can supply continuously and regularly under definitely prescribed conditions, the conditions and commercial value of the steam, the character of the combustion and the actual conditions of operation of the boiler when at work.

In 1899 a Committee on the Revision of the Code of 1885 for Conducting Steam-Boiler Trials presented its report, which is known as the Code of 1889 and shows a marked development over the original code of 1885, giving especial consideration to the fuel question and also endeavoring to overcome difficulties encountered in the West with the first code. This code is printed in Paper 827, while Paper 828 gives the discussion on the report at the New York Meeting of 1899.

In 1890 the Committee on a Standard Method of Conducting Duty Trials of Pumping Engines presented a report to furnish a common basis on which to compare the economy of different engines, and proposed a new basis for economy of 1,000,000 B.t.u. in place of 100 lb. of coal (Paper 381).

In 1892 a committee reported on standards for tests of engines and machinery at the Columbian World's Fair with a view to giving them a real scientific and comparable value (Paper 503).

In 1893 the committee on a Standard Method of Conducting Locomotive Tests presented its report covering shop tests and road tests (Paper 552).

In 1902 a Committee appointed to standardize a system of testing steam engines presented its final report, known as the Code of 1902, which gives extensive rules covering the various phases of steam-engine tests (Paper 973). The discussion of this final report is given in Paper 974.

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In 1904 the Society's Committee, coöperating as an advisory body with the Pennsylvania Railroad Company in conducting tests on locomotives at the Louisiana Purchase Exposition in St. Louis, presented its report (Paper 1109), and in 1914 the Sub-Committee on Railroads of the Committee on Meetings presented a report on steam locomotives of that day, summarizing the progress made since the Louisiana Purchase Exposition (Paper 1448).

In 1908 the matter of standardization of gas-engine tests was discussed, the discussion hinging mainly on gas-engine efficiency and heat value of gas, with arguments for the use of total-heat values and effective-heat values. A revised code for testing gas engines was submitted to the Council, with suggestions that the revision be placed in the hands of the Gas Power Section of the Society, now the Sub-Committee on Gas Power of the Committee on Meetings.

At the 1908 meeting a motion was carried providing for the revision of the report, then about three years old, on standard methods for conducting tests of gas engines. It was suggested that it would be desirable to revise the standards for testing of engines, placing all upon the heat-unit basis, the only proper basis for a duty test of an engine or for engine guarantee.

In 1909 the Committee on Revision and Extension of the Code for Testing Gas Power Machinery requested that their committee be discharged and suggested that a new committee be appointed to revise, unify and standardize all the present codes of the Society covering their various subjects. The Committee on Revision of the Standard Code on Steam-Boiler Tests also recommended that a revision be undertaken and a committee be appointed. It was voted that a committee of nine, to be named The Committee on Power Tests, be appointed to "revise the present testing codes of the Society relating to boilers, pumping engines, locomotives, steam engines in general, internal-combustion engines

and apparatus and fuel therefor, and to extend these codes so as to apply to such power-generating apparatus as the present codes do not cover, including water power, and bring them into harmony with each other and with the best practice of the day." This committee was given power to resolve itself into as many sub-committees as might be required, the sub-committees to cooperate with and report to the whole committee. The final report of the Power Test Committee was presented at the Annual Meeting in 1915 and is printed in Paper 1526. Subsequently a permanent committee was appointed to interpret the rules and to make revisions from time to time, also to hold meetings at which interested parties might have an opportunity to present suggestions, following the precedents of the Boiler Code Committee.

At the Annual Meeting, December 1917, a public meeting was held by the Power Test Committee for the discussion of the various sections of the Power Test Code and the suggestions made at that time are being used as the basis for the revision of the code.

During the past year a sub-committee was appointed to assist in the revision of the water-wheel section of the code.

**Electrical Standards.** In 1897 the National Conference on Standard Electrical Rules presented its report, known as the National Electrical Code. This code (Paper No. 790) gives seventy-two rules divided into six classes. In 1903 the National Conference on Standard Electric Lighting Rules presented its report, proposing amendments to the National Electric Code Rules (Paper 977).

694 In 1901 the Committee on Standardization of Engines and Dynamos proposed standards for direct-connected engines and generators (direct-current—Paper 887), and in 1901 the committee presented a report embodying their final conclusions and recommendations (Paper 916). In 1905 the same committee presented an appendix to its report concerning the reduction of engine-shaft diameter beyond armature fit (Paper 1056).

In 1913, at the invitation of the American Institute of Electrical Engineers, a committee was appointed to cooperate with the Standards Committee and report concerning the use of the *myriawatt* as a unit. The report was presented at the Spring Meeting of that year.

In 1916 the Conference Committee on Electrical Engineering Standards considered the proposal to form a Joint Standards Committee with representation from all the national engineering societies, to act as a senate and give final approval to any standards proposed by the constituent societies.

The Conference Committee on Electric Power is cooperating with the Subcommittee on Cost of Electric Power of the Committee on Standards of the American Institute of Electrical Engineers.

**Flanges.** The Committee on Flange Standardization reported its first standards in Papers 481 and 504, in which a table of proposed standards was submitted. Paper 826 gives the schedule of standard flanges adopted in 1899. The continually increased pressures to be resisted and the increasing diameter of pipe for large power stations, however, called for extensions of this standard.

In December 1901 the Committee on Standard Pipe Unions presented its report based on joint conferences with committees of other societies (Paper 917), and a supplementary report in 1902 (Paper 948).

In 1912 a special committee on flanges, cooperating with the National Association of Master Steam and Hot Water Fitters, formulated the 1912 schedule of standard-weight and extra heavy flanges and flanged fittings, which has



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been adopted by the United States Government and by numerous organizations.

In 1913 the Committee on Standardization of Flanges presented recommendations as to a new standard to be known as the American Standard, to become effective January 1, 1914. This standard was arrived at after conferences with the Master Steam and Hot Water Fitters' Association and the Manufacturers' Committee, and is a compromise consistent with good engineering practice between the 1912 U. S. Standard heretofore recommended and that recommended in the same year by the manufacturers (Paper 1430).

During 1916 the Manufacturers' Standards Committee, representing companies manufacturing pipes and fittings, requested the coöperation of the Society's Committee on Standard Flanges and Pipe Fittings in the standardization of flanges for hydraulic work. Later this committee was asked to include flange fittings for ammonia apparatus and also steel fittings, and, by request of the American Railway Master Mechanics' Association, pipe unions. The title of the committee was changed to that of the Committee on Standards for Flanges and Pipe Fittings. The committee has since investigated the strength of the various sizes and weights of rolled-steel piping, thickness of pipe walls for cast-steel and semi-steel pipe and fittings, proportions for flanges, bolting and fittings for hydraulic pressures of 800, 1200 and 3000 lb. working pressure per square inch. A report covering these high pressures was presented at the Annual Meeting, December, 1917 (Paper 1654).

**Screw Threads.** A Committee on Standard Pipe and Pipe Threads formulated and recommended the Briggs standard, offered by the late Robert Briggs, of Philadelphia, a member of the Society. The report was presented in 1887; the standards are given in Papers 226 and 241.

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A conference on the International Standardization of Pipe Threads was held in Paris, France, in 1908. The Society appointed a special committee whose report was forwarded for presentation at that conference. In 1913 the Committee on International Standards for Pipe Threads sent to the Paris representative instructions for presentation to the International Commission on Pipe Threads, which was initiated by the Société Technique de l'Industrie du Gaz in France. The American Gas Institute sent identical instructions to its representative.

The Committee on Standardization of Special Threads for Fixtures and Fittings presented its report in June 1915, giving standard dimensions for rolled threads for screw shells of electric sockets and lamp bases, and in December 1915 reported similarly for straight pipe threads (Papers 1474 and 1525).

In 1912 a committee was appointed to prescribe the permissible tolerances in the commercial manufacture of taps, bolts and screws, including their measurement. This committee is called the Committee on Tolerances in Screw Thread Fits and has rendered an elaborate progress report which was presented for discussion at the Spring Meeting of 1918. In preparing this report several thousand screws and bolts were inspected, a large number of special gages were made for trial use by manufacturers, and the theoretical aspect of the whole question was gone into with the utmost thoroughness.

**Machine Screws.** At the New York Meeting in December 1905 the Committee on Standard Proportions for Machine Screws presented its preliminary report, and at the Chattanooga Meeting in 1906 its completed report, with appended comment. This report was referred back for final revision.

At the New York Meeting in December 1906 a revised report was presented

and discussions read, but on account of numerous requests it was referred back to the committee for another revision, and the final report was presented and accepted at the Indianapolis Meeting in May 1907. (See Papers 1142 and 1142-A.)

The report has been adopted by the Navy Department of the United States and embodied in the Department's specifications.

**Machine-Screw Nuts.** In 1917, at the request of the Navy Department of the United States, a joint committee of the Society and of the Society of Automotive Engineers was appointed to consider the question of the standardization of machine-screw nuts.

**Committee on Screw Threads and Threaded Parts.** In order to secure co-ordinated effort on the part of the various committees engaged upon the standardization of screw threads, an advisory committee has been appointed with a membership composed of members of these several other committees. This advisory committee aims to keep in touch with the requirements of screw-thread standardization and to assign standardization work to sub-committees as required.

**Government Commission to Standardize Screw Threads.** Through the passage of a bill by Congress, which this Society assisted in bringing about, a Government commission has been formed to undertake a national standardization of screw threads. The commission is composed of two members from The American Society of Mechanical Engineers, two from the Society of Automotive Engineers, and one each from the Army, the Navy and the Bureau of Standards.

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**Gages.** In 1882 a Committee on Standards and Gages reported on the Rogers-Bond Comparator (Paper 90).

In 1885 the Committee on a Standard Thickness Gage for Metals presented its report, recommending the use of the gage whose number for each thickness is the number of thousandths of a standard inch in that thickness (Paper 633).

In 1913 the Committee on Standardization of Pipe Thread Gages presented its report fixing manufacturing limits for the use of the Briggs Standard Pipe Thread Gages (Paper 1399).

**Gage Committee.** This committee was appointed to assist the Government in establishing and maintaining standard gages used in the production of munitions of war. The committee recommended that there be but one place for the certification of gages and that master gages be located in different industrial centers. The recommendations were generally accepted and the Bureau of Standards agreed upon as the place for certification.

**Measuring and Recording Standards.** In 1902 the committee appointed to discuss the arguments in favor of and against the Metric System presented a report giving the points of general agreement and also stating the pro-metric and anti-metric sides of the case (Paper 972).

In 1905 a committee presented a preliminary report on standard abbreviations, symbols, etc., in technical papers, giving fourteen rules with a list of examples (Paper 1054).

In 1905 the committee appointed to suggest a standard tonnage basis for refrigeration presented its preliminary report, confining itself to a thermal rating and the establishment of a set of conditions representing good average engineering practice (Paper 1055).

In 1913 the Committee on Standardization of Catalogues presented its

## DATA ON A. S. M. E. STANDARDS

report recommending standard sizes for catalogues, folders, paper boxes, etc. (Paper 1394).

In 1914 the Committee on Standard Cross-Sections and Symbols presented its report (Paper 1468), and

In 1916 the Joint Committee on Standards for Graphic Presentation presented a preliminary report, which was published for the purpose of inviting suggestions.

**Safety Standards.** In 1915 the Sub-Committee on Machine Shop Practice of the Committee on Meetings presented a report, being a safety code for the use and care of abrasive wheels, covering protection flanges, protection hoods and protection chucks (Paper 1523).

In 1916 the Sub-Committee on the Protection of Industrial Workers of the Committee on Meetings presented a Code of Safety Standards for Electric Traveling Cranes, including rules for crane operators, floormen and repairmen (Paper 1572).

At the Spring Meeting in Cincinnati, May 1917, an Industrial Safety Session was held under the auspices of the Sub-Committee on Protection of Industrial Workers. Tentative drafts of two safety codes were presented and discussed and appear in final form in Vol. 39 of TRANSACTIONS. The first was a code of safety standards for industrial ladders (Paper 1597), and the second referred to safety standards for power-transmission machinery (Paper 1598). The latter was compiled under the direction of the Committee on Health and Safety of the National Association of Manufacturers. A code of safety standards for woodworking-machine guards was also presented at the Annual Meeting, 1917 (Paper No. 1631).

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**Miscellaneous.** In 1884 a committee reported on Natural Gas for Industrial Purposes, including its chemical composition, illuminating power and industrial uses (Paper 151).

In 1904 the Alloy Research Committee presented an appendix to its sixth report, being a summary of various papers on effect of strain and of annealing (Paper 1034).

In 1911 the Committee on Identification of Power House Piping presented a report recommending distinguishing colors to be used on valves, flanges and fittings of steam, gas, water and other pipe lines, etc. (Paper 1305).

In 1912 the Sub-Committee on Machine Shop Practice presented a report on the Development of Machine Shop Practice through the Preceding Decade (Paper 1367).

In 1912 the Sub-Committee on Administration presented a report on the Present State of the Art of Industrial Management (Paper 1378).

The Sub-Committee on Fire Protection recommended a National Standard for Hose Couplings, which the Council ordered printed (Paper 1398). These standards are compromise standards which were agreed upon at a joint conference with a number of organizations interested.

In 1913 the Sub-Committee on Hoisting and Conveying presented a report reviewing developments and making certain preliminary recommendations (Paper 1403).

In 1914 the Committee on a Code of Ethics presented its recommendations regarding engineers' relations to clients, employers, etc. (Paper 1429).

In 1914 the Committee on Resolutions of the Snow Removal Conference

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held in Philadelphia, presented a report reviewing methods adopted in the principal cities (Paper 1450).

In 1909 a Committee on Standards for Involute Gears was appointed to formulate standards and report to the Council. It presented a majority report four years later.

The Committee on Recommended Practice for Standardization of Filters presented its report at the Annual Meeting, December 1916. It is printed in Vol. 39 of *TRANSACTIONS* (Paper 1600).

### III ENUMERATION AND ABSTRACTS OF STANDARD COMMITTEES' REPORTS

In the following list are given, in the order of A. S. M. E. paper numbers, the reports of the various Standards Committees, with a short abstract of each paper. For more detailed information readers are referred to the volumes of *TRANSACTIONS* and *THE JOURNAL* of the Society, particulars of which are given with each abstract.

Reports on which no definite action has been taken as yet, and which do not, therefore, appear in this list, are mentioned under the heading *Miscellaneous* of the preceding summary.

Where reports have been superseded they are so marked. Prices of reports to non-members are included in the cases of reports still in force; prices to members are one-half those specified.

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#### Paper 90

#### REPORT OF COMMITTEE ON STANDARDS AND GAGES, ON THE ROGERS-BOND COMPARATOR

Presented and discussed at New York, November 1882. Printed in *Trans. Am. Soc. M. E.*, Vol. 4 (1883), pp. 21 to 29. (*Out of print*)

The comparator is used for comparing line measures of length with attested copies of the standard bars, subdividing these line measures and reducing them to end measures. The degree of accuracy attained is said to be such that no future improvements can occasion changes sufficiently great to affect the practical usefulness of the magnitudes determined or the interchangeability of structures based upon them with those involving further refinements.

#### Paper 151

#### REPORT ON NATURAL GAS FOR INDUSTRIAL PURPOSES

Presented and discussed at Pittsburgh, May 1884. Printed in *Trans. Am. Soc. M. E.*, Vol. 5 (1884), pp. 340 to 375. 4 tables. (*30 cents*)

This report deals with the chemical composition of natural gas from Western Pennsylvania, its fuel value, illuminating power, and its uses in the industries; natural-gas piping practice, explosibility, pressure and temperature of gas from the well. It concludes with a discussion of the laws (34 P. L. 93) of Pennsylvania relating to water, gas, light and heat companies, and recommends further legislation. It also proposes measures to natural-gas consumers tending to security and economy.

## DATA ON A. S. M. E. STANDARDS

### Paper 168

#### REPORT OF COMMITTEE ON A STANDARD METHOD OF STEAM-BOILER TRIALS

Presented at New York, November 1884, and discussed at Atlantic City, May 1885. Printed in Trans. Am. Soc. M. E., Vol. 6 (1885), pp. 256 to 313. Discussion, pp. 314 to 351. 5 figs., 2 tables, 3 logs. (Superseded by Paper 827)

(CODE OF 1885)

The code proposed provides that the object of the test shall be precisely stated before the trial, and that an understanding be reached in regard to the kind of fuel to be used. During the trial the essential provisions are the preservation of the utmost possible uniformity of working conditions, the method of keeping the record of the test, and analyses of the escaping gases, when practicable.

The committee recommends as the "unit of evaporation" "one pound of water at 212 deg. fahr. evaporated into steam at the same temperature." For "commercial horsepower" it accepts the unit of "an evaporation of 30 lb. of water per hour from feedwater into steam at 70 lb. gage pressure." (This standard is equal to 33,305 thermal units per hour.)

### Paper 226

#### REPORT OF COMMITTEE ON STANDARD PIPE AND PIPE THREADS

Presented and discussed at New York, November 1886. Printed in Trans. Am. Soc. M. E., Vol. 8 (1887), pp. 29 to 44. 1 fig., 2 tables. (10 cents)

The committee expresses the opinion that the Briggs Standard is the proper standard to be adhered to, and that it only requires definite coöperation on the part of pipe manufacturers with the committee, in order to bring their product strictly to that standard and to adopt means of strictly adhering to it within practical limits. An appendix gives complete data upon which the Briggs standard pipe-thread sizes are based, and a table of standard dimensions of wrought-iron welded tubes up to 10 in. in diameter.

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### Paper 241

#### FINAL REPORT OF THE COMMITTEE ON STANDARD PIPE AND PIPE THREADS

Presented at Washington, June 1887. Printed in Trans. Am. Soc. M. E., Vol. 8 (1887), pp. 347 to 350. (10 cents)

This report is on the consideration of a standard for pipe threads for purposes other than that which is covered by the Briggs formulæ and tables.

### Paper 378

#### APPENDIX II TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING

Presented at New York, November 1889. Printed in Trans. Am. Soc. M. E., Vol. 11 (1890), pp. 527 to 572. 3 figs., 1 table. Index. (Superseded by Paper 551)

Resolution of the conferences held at Munich, September 1884, and Dresden, September 1886, relative to uniform methods of procedure in testing building and structural materials. (See Paper 380.)

# REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented and discussed at Cincinnati, May 1890. Printed in Trans. Am. Soc. M. E., Vol. 11, pp. 604 to 653. 6 figs., 19 tables. Index. Appendix.  
(Out of print)

Progress report on methods of conducting standard or scientific tests, in contradistinction to routine or shop tests, setting forth proposed recommendations under the following heads:

- I General Recommendations
  - 1 Necessary conditions of testing machines
  - 2 Holding appliances
  - 3 Standard apparatus for routine testing
  - 4 Standard drop-test apparatus
  - 5 Determination of those qualities of material which suggest its adoption
  - 6 Remarks on testing machine to accompany reports
  - 7 Amplification of reports by stating source of test pieces, etc., etc.
  - 8 Influence of time on tests
- II Tests of Wrought Iron and Steel
  - A Rails
  - B Axles
  - C Tires
  - D Wrought iron for structural purposes
  - E Low steels for structural purposes
  - F High steels for structural purposes
  - G Wrought iron for boilers
  - H Low steels for boilers
  - I Materials used in shipbuilding
  - J Wire
  - K Wire rope
- III Cast Iron
- IV Copper, Bronze, and Other Metals
- V Woods
- VIII Method of Testing
  - 1 General recommendations for testing finished pieces in original shape
  - 2 Tension test in general
  - 3 Compression tests
  - 4 Transverse tests
  - 5 Torsion tests
  - 6 Multiple or piece tests
  - 7 Welding tests
  - 8 Bending tests
  - 9 Hardening tests
  - 10 Forging tests
  - 11 Punching tests
  - 12 Abrasion test
- IX Shape of Test Pieces
  - 1 For tension tests
  - 2 For compression tests
  - 3 For transverse tests
  - 4 For torsion tests
  - 5 For bending tests
  - 6 Multiple or piece, welding, hardening, and abrasion tests.

The report also takes up the question of an international standard for testing materials, reviewing testing practice in France, Great Britain and Germany.

An addendum (see Paper 378) gives the general results and deliberations of a number of successful conferences held by German, Austrian, Swiss and Russian

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engineers to adopt standard methods, test pieces and machines. Their recommendations having been introduced universally, and, being in all essential particulars identical with custom in Great Britain and the United States, the committee considers it advisable to incorporate them.

### Paper 381

#### REPORT OF COMMITTEE ON A STANDARD METHOD OF CONDUCTING DUTY TRIALS OF PUMPING ENGINES (REVISED FORM)

Presented and discussed at Cincinnati, May 1890. Printed in Trans.  
Am. Soc. M. E., Vol. 11 (1890), pp. 654 to 687. 2 figs., 3 tables. Appendix.  
Discussion. Vol. 12 (1891), pp. 563 to 602. (Superseded by Paper 1526)

The main object of the standard proposed is to establish a mode of determining whether or not the guaranteed duty of a pumping engine is realized, and to furnish a common basis on which to compare the economy of different engines. The abolition of the unit of "100 lb. of coal" in favor of the new basis of "1,000,000 heat units" is proposed. Formulæ are recommended for computing duty and other quantities relating to performance.

In order that a contract between builder and purchaser may conform to the proposed standard, a number of guarantees stated are recommended. The report describes the standard method of conducting duty trials, under the headings:

- 1 Test of Feedwater Temperatures
  - Directions for obtaining temperatures
  - Directions for measurement of feedwater
- 2 Main Duty Trial
  - Mode of procedure
  - Directions regarding arrangement and use of instruments
- 3 Leakage Test of Pump
- 4 Table of Data and Results
  - Duty trial of engine
  - Data and results of boiler test.

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An appendix contains memoranda in regard to measurement of water by means of weirs, venturi tubes and nozzles.

### Paper 479

#### APPENDIX II TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented for record at New York, November 1891. Printed in Trans.  
Am. Soc. M. E., Vol. 13 (1892), pp. 275 to 288. (10 cents)

Minutes of the third conference for the unification of standard methods of testing materials of construction, held at Berlin, September 1890. (See Paper 380.)

### Paper 480

#### APPENDIX IV TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented for record at New York, December 1891. Printed in Trans.  
Am. Soc. M. E., Vol. 13, pp. 289 to 296. 2 figs. (10 cents)

Lecture by Prof. N. Bebelubsky, of St. Petersburg, on Comparison of Standard Shapes of Tension Pieces. (See Paper 380.)

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Paper 481

REPORT OF THE COMMITTEE ON FLANGE STANDARDIZATION

Presented at San Francisco, May 1892. Printed in Trans. Am. Soc. M. E., Vol. 13 (1892), pp. 307 to 317. Appendix. (See Paper 504)

A progress report giving the forms of inquiry used by the committee to obtain the necessary information for compiling standards.

Paper 503

REPORT OF COMMITTEE ON METHODS FOR PHYSICAL AND MECHANICAL TESTS ON STEAM ENGINES AND MACHINES AT THE WORLD'S COLUMBIAN EXPOSITION, 1893

Presented at New York, November 1892. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 41 to 47. (*Out of print*)

International expositions furnish an opportunity for careful tests of the relative merits of the various products, manufactures, machines and methods developed under different conditions in various parts of the world. This report enumerates the tests which it is desirable to undertake with references principally to prime movers and natural products, materials and apparatus used in connection therewith.

Paper 504

REPORT OF THE COMMITTEE ON FLANGE STANDARDIZATION

Presented at New York, November 1892. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 48 to 51. 1 fig., 1 table. (Superseded by Paper 826)

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The committee submits a table of proposed standards, tables of sizes in use by manufacturers, and a plotted diagram showing graphically the suggested scale of sizes. Scales for two pressures are proposed for sizes of 24 in. and over, one for pressures ranging up to 80 lb. and the other to 200 lb.

Paper 550

REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented at the Engineering Congress, Chicago, August 1893. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1258 to 1261. (*10 cents*)

In this report the committee announces that it will present from time to time data and results from outside sources, the correctness of which has been developed and demonstrated at home or abroad.

Paper 551

APPENDIX V TO REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented at the Engineering Congress, Chicago, August 1893. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1263 to 1311. 3 figs. Index. (Supersedes Paper 378). (*30 cents*)

Resolutions of international conferences held at Munich, Dresden, Berlin and Vienna, relative to uniform methods of procedure in testing building and structural materials to determine their mechanical properties. This appendix supersedes Appendix II (Paper 378), in which a number of modifications must be made in order to make it agree with facts developed since the presentation of the appendix. The principal differences consist in rules for bending tests, tests of boiler plate, copper, and tiles, and finally the recommendations of a standard



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length of test piece developed from the proven relation of length and cross-section of test piece on results.

### Paper 552

#### REPORT OF COMMITTEE ON A STANDARD METHOD OF CONDUCTING LOCOMOTIVE TESTS

Presented and discussed at the Engineering Congress, Chicago, August 1893. Printed in Trans. Am. Soc. M. E., Vol. 14 (1893), pp. 1312 to 1339. 8 figs., 2 tables. (Superseded by Paper 1526)

The committee reports that for determining economy of boiler and engine, economy of compound and simple locomotives, and effect upon the economy produced by different classes of fuel and various methods of operation, the "shop test" is especially adapted; for determining other problems and to ascertain the performance of the engine in regular work, the "road test" should be used. In making road tests a dynamometer car should be employed, so as to obtain thereby the pull upon the drawbar. Tests should be conducted with such completeness that all the information relating to the performance of both the boiler and cylinders are determined.

As a standard basis for comparing efficiency, the number of pounds of standard coal burned per dynamometer horsepower per hour is recommended. The term "standard coal" refers to coal having a total heat of combustion of 12,500 B.t.u. per lb.

### Paper 633

#### REPORT OF COMMITTEE ON STANDARD THICKNESS GAGE FOR METALS

Presented and discussed at Detroit, June 1895. Printed in Trans. Am. Soc. M. E., Vol. 16 (1895), p. 641. (30 cents)

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The committee reports its success in bringing into acceptance the use of a gage whose number for each thickness is the number of thousandths of a standard inch in that thickness. Where a notched gage is used the suggested standard form is an oval gage, stamped with the words Decimal Gage.

### Paper 654

#### REPORT OF COMMITTEE ON STANDARD TESTS AND METHODS OF TESTING MATERIALS

Presented and discussed at Detroit, June 1895. Printed in Trans. Am. Soc. M. E., Vol. 16 (1895), pp. 1066 to 1081.

Results of an investigation showing the relation between different sizes of castings poured from iron of a uniform composition, the chemical composition of each size of casting when cold, and the physical properties of each. The tests were made in actual foundries.

The chemical composition represented all foundry mixtures from white iron to the softest gray; the physical properties determined were the grain, the shrinkage, the chill and the strength. Reports were made of the transverse, tensile and crushing strengths, and logs were included giving maximum fiber distance, moment of inertia, total stress, deflection, maximum stress on outer fiber, shearing stress, modulus of elasticity and resilience.

This report is supplemented by Paper 655, Transverse Strength of Cast Iron (review of results of above tests), by W. J. Keep; and Paper 656, Keep's Cooling Curves—A Study of Molecular Changes in Metals Due to Varying Temperatures, by the same author, and printed in the same volume.

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**Paper 698**

**APPENDIX TO REPORT NO. 380 OF COMMITTEE ON STANDARD METHODS  
OF TESTS AND TESTING MATERIALS**

Published in Trans. Am. Soc. M. E., Vol. 17 (1896), pp. 748 to 757. (10  
cents)

Proceedings of the Fifth International Conference for the unification of methods  
of testing building and structural materials, held at Zurich, September 1895.

**Paper 790**

**REPORT OF NATIONAL CONFERENCE ON STANDARD ELECTRICAL  
RULES**

Presented at New York, November 1897. Printed in Trans. Am. Soc.  
M. E., Vol. 19 (1898), pp. 984 to 1021. 3 tables. Index. (30 cents)

**(NATIONAL ELECTRICAL CODE)**

Rules adopted by a National Conference on Standard Electrical Rules com-  
posed of representatives from sixteen bodies, including the Society. The rules  
are divided as follows:

Class A: Central stations, dynamo, motor and storage- battery rooms, transformer substations, etc.....	Rules 1-11
Class B: Outside work all systems and voltages.....	Rules 12-13
Class C: Inside work.....	Rules 14-39
Class D: Specifications for wires and fittings.....	Rules 40-55
Class E: Miscellaneous.....	Rules 56-59
Class F: Marine wiring.....	Rules 60-72

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**Paper 826**

**REPORT OF COMMITTEE ON FLANGE STANDARDIZATION**

Presented at New York, December 1899. Printed in Trans. Am. Soc.  
M. E., Vol. 21 (1900), pp. 29 to 33. 1 fig., 1 table. (Supersedes Papers  
481 and 504. Superseded by Paper 1430)

This report contains the schedule of standard flanges adopted by a com-  
mittee of the Master Steam and Hot Water Fitters' Association, the American  
Society of Mechanical Engineers, and the leading valve and fitting manufacturers  
of the United States. This schedule is called the August 1894 schedule, and  
differs from the schedule in Report No. 504 in the 2 $\frac{1}{4}$ -in., 3 $\frac{1}{4}$ -in., 4-in., 9-in., and  
12-in. sizes, the difference being in the flange diameters.

The report also contains a sample "Bates Flange Chart," prepared by Edward  
P. Bates, of the committee.

**Paper 827**

**REPORT OF COMMITTEE ON THE REVISION OF THE SOCIETY CODE  
OF 1885, RELATIVE TO A STANDARD METHOD OF CON-  
DUCTING STEAM-BOILER TRIALS**

Presented and discussed at New York, November 1899. Printed in  
Trans. Am. Soc. M. E., Vol. 21 (1900), pp. 34 to 111. 8 figs., 41 appendices.  
(Superseded by Paper 1526)

**(CODE OF 1899)**

When the Committee of 1885 formulated its code, the only coals in question  
were the anthracite of the Lehigh Valley and other coals of Eastern Pennsylvania,  
and the Cumberland coal as bituminous coal. Revision of the code is due

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largely to the fact that in its application in the Middle and Far West many difficulties were encountered and there was opposition to certain rulings. The revision is the result of the committee's effort to overcome this opposition. The amendments relate to the use of improved steam calorimeters, to sampling coal and determining its moisture, to calorific tests and analysis of coal, to analysis of flue gases, to smoke observations, to determinations of efficiency, and to methods of working out the heat balance.

### Paper 828

#### DISCUSSION UPON THE PROVISIONAL AND AMENDED DRAFTS OF THE REPORT OF THE COMMITTEE ON THE REVISION OF THE CODE OF 1885, RELATIVE TO A STANDARD METHOD FOR CONDUCTING STEAM-BOILER TRIALS

Presented at New York, December 1899. Printed in Trans. Am. Soc.  
M. E., Vol. 21 (1900), pp. 112 to 138. (20 cents)

This discussion relates to the previous paper, No. 827.

### Paper 887

#### REPORT OF COMMITTEE ON STANDARDIZATION OF ENGINES AND DYNAMOS

Presented and discussed at Milwaukee, May 1901. Printed in Trans. Am.  
Soc. M. E., Vol. 22 (1901), pp. 520 to 530. 1 fig., 1 table. (Superseded by  
Paper 916)

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The second report of this committee. The first report was a progress report, made at Cincinnati, May 1900, and printed in Trans. Am. Soc. M. E., Vol. 21 (1900), pp. 776 to 781, proposing standards for electric generators.

This report covers all the features of engines and dynamos to be standardized, with the exception of proportions of keys, and shrinkage allowance for armature fits. Its recommendations include:

- 1 Standard sizes of units
- 2 Corresponding r. p. m. for these units
- 3 Sizes of shaft for the two classes of center-crank and side-crank engines
- 4 Length along shaft required for generator
- 5 Height of axis of shaft over top of sub-base
- 6 Width of top of sub-base
- 7 Armature fit
- 8 Overload capacity of generators
- 9 Brush holders
- 10 Holding down bolts, keys and outboard bearings

### Paper 916

#### FINAL REPORT OF COMMITTEE ON STANDARDIZATION OF ENGINES AND DYNAMOS

Presented and discussed at New York, December 1901. Printed in Trans.  
Am. Soc. M. E., Vol. 23 (1902), pp. 99 to 110. 2 figs., 1 table. (See also  
Paper 1056.) (10 cents)

This report includes the features of Paper 887, together with recommendations of the points remaining to be standardized.

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### Paper 917

#### REPORT OF THE COMMITTEE ON STANDARD PIPE UNIONS, PREPARED IN JOINT CONFERENCE WITH SIMILAR COMMITTEES OF THE AMERICAN RAILWAY MASTER MECHANICS' AS- SOCIATION AND THE MASTER CAR BUILDERS' ASSOCIATION

Presented and discussed at New York, December 1901. Printed in Trans.  
Am. Soc. M. E., Vol. 23 (1902), pp. 111 to 124. 17 figs., 1 table. (See also  
Paper 948.) (10 cents)

The committee undertook the complete design of commercial sizes of malleable pipe unions for wrought-iron pipe from  $1\frac{1}{2}$  in. to 4 in. inclusive. The mark "S" on the side of the nut was recommended as a designating mark, and this was copyrighted on the recommendation of the committee.

### Paper 948

#### SUPPLEMENTARY REPORT OF COMMITTEE ON STANDARD PIPE UNIONS

Presented and discussed at Boston, May 1902. Printed in Trans. Am.  
Soc. M. E., Vol. 23 (1902), pp. 681 to 685. 4 figs. (See also Paper 917.)  
(10 cents)

Following the publication of Report No. 917, some slight criticisms of certain parts of the designs were received. These criticisms are answered in this supplementary report.

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### Paper 972

#### REPORT OF COMMITTEE APPOINTED TO DISCUSS THE ARGUMENTS IN FAVOR OF AND AGAINST THE METRIC SYSTEM

Presented and discussed at New York, December 1902. Printed in Trans.  
Am. Soc. M. E., Vol. 24 (1903), pp. 630 to 712. 21 appendices. (60 cents)

As a result of the report of the House Committee on Coinage, Weights and Measures, recommending the passage by Congress of the Metric-System Bill, a committee was appointed to present a report. The committee agreed upon the following points:

- 1 Legislation designed to compel the exclusive use of the metric system is not desirable
- 2 Such legislation could not be enforced in any event so far as transactions between private individuals are concerned.
- 3 The general government has the power to specify the system to be used in its own work and business, and can require that work done for it by contractors shall conform to any specified measurements or weights
- 4 The government cannot compel any one to bid upon its specifications
- 5 Recognizing the well-settled fact that the consumer does and must pay all necessary costs of production, if the government specifies such dimensions as will materially increase costs of production, the government and not the bidder will have to pay such increased costs, it being self-evident that a bidder, not compelled to bid, will not bid except at a price which will afford him a profit
- 6 The bill now before Congress is intended to make the use of the metric system compulsory in the several departments of the government, but it cannot make it compulsory in private transactions

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- 7 There is no force in that class of arguments which consists in taking integral dimensions in one system, translating them into equivalent and, therefore, fractional dimensions in the other system and then making comparisons. Such arguments can be made as strong for the one system as for the other.

In addition, members of the committee in favor of the metric system prepared a statement, and those against it prepared an answering argument, both of which are printed in the report.

### Paper 973

## FINAL REPORT OF COMMITTEE APPOINTED TO STANDARDIZE A SYSTEM OF TESTING STEAM ENGINES

Presented at New York, December 1902. Printed in Trans. Am. Soc. M. E., Vol. 24 (1903), pp. 713 to 790. 18 figs., 5 tables. (Superseded by Paper 1526)

(CODE OF 1902)

A proposed standard for testing in a scientific and practical way all the particular classes of engines, whatever the nature of their services, without conflicting with the recommendations of former committees of the Society relating to pumping-engine tests, locomotive tests and boiler tests.

The Committee recommends that the standard of consumption should be referred to heat units, that indicated and brake horsepower be used as units of mechanical power, and that for the purpose of comparing economies the number of heat units consumed per hour, both per indicated and per brake horsepower, be used.

The committee gave due attention to a report of the Institution of Civil Engineers on the Definition of a Standard or Standards of Thermal Efficiency for Steam Engines.<sup>1</sup>

The committee chose as one of the important subsidiary forms of expressing efficiency that based on a so-called "standard coal" unit. The term "standard coal" refers to a coal which imparts to the steam 10,000 B.t.u. for each pound of dry coal consumed. (Calorific value, 12,500 B.t.u. per lb.)

The general recommendation in the report is, first, to satisfy the special object in view; that is, to lay down a form of test which shall serve as a standard for all steam engines, whatever their service, viz., the heat-unit test; second, to supplement the standard system thus framed with provisions for systematically determining other forms of expressing efficiency in steam engines; third, and as a further supplement, to standardize the methods of testing steam engines and results obtained with reference to their particular service, so far as this has not been heretofore accomplished; and fourth, to systematize the work of testing gas, oil and other internal-combustion engines. The tables of data and results recommended are planned accordingly.

The rules for conducting steam-engine tests include:

- 1 Object of test
- 2 General condition of plant
- 3 Dimensions, etc.
- 4 Coal
- 5 Calibration of instruments
- 6 Leakages of steam, water, etc.
- 7 Duration of test
- 8 Starting and stopping a test
- 9 Measurement of heat units consumed by engine
- 10 Measurement of feedwater or steam consumption of engine, etc.

<sup>1</sup> Proc. Inst. C. E., 1898, and as embodied in the British Standard Analysis Code.

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- 11 Measurement of steam used by auxiliaries
- 12 Coal measurement
- 13 Indicated horsepower
- 14 Testing indicator springs
- 15 Brake horsepower
- 16 Quality of steam
- 17 Speed
- 18 Recording the data
- 19 Uniformity of conditions
- 20 Analysis of indicator diagrams
- 21 Standards of economy and efficiency
- 22 Heat analysis
- 23 Temperature-entropy diagram
- 24 Ratio of economy of an engine to that of an ideal engine
- 25 Miscellaneous
- 26 Report of test.

### Paper 974

#### DISCUSSION OF PRELIMINARY FORMS OF REPORT OF COMMITTEE ON STANDARDIZING ENGINE TESTS

Presented at Milwaukee, May 1901, New York, December 1901, and  
Boston, May 1902. Printed in Trans. Am. Soc. M. E., Vol. 24 (1903), pp.  
791 to 846. (40 cents)

This includes the discussion of the first report of the committee at the New York Meeting, December 1902. In closing the discussion the committee states that the various criticisms and suggestions have been carefully weighed and that the report as it now stands embodies the final conclusions.

### Paper 977

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#### REPORT ON MEETING OF NATIONAL CONFERENCE ON STANDARD ELECTRIC LIGHTING RULES

Presented at Saratoga, June 1903. Printed in Trans. Am. Soc. M. E.,  
Vol. 24 (1903), pp. 885 to 888. (10 cents)

Amendments proposed by the A. S. M. E. delegate to the National Conference on Standard Electrical Rules, to the following National Electrical Code Rules:

- No. 12 Constant-potential pole lines over 5000 volts
- No. 13 Grounding low-potential circuits
- No. 64 Signalling systems.

### Paper 978

#### REPORT OF SPECIAL COMMITTEE ON RULES AND METHODS

Presented at Saratoga, June 1903. Printed in Trans. Am. Soc. M. E.,  
Vol. 24 (1903), pp. 891 to 920. (30 cents)

Second revised edition of the draft of the Constitution, By-Laws and Rules of the Society, with changes and amendments submitted by members and accepted by the committee previous to June 1, 1903.

### Paper 979

#### REPORT OF THE COMMITTEE ON SPECIFICATIONS FOR BOILER PLATE, RIVET STEEL, STEEL CASTINGS AND STEEL FORGINGS

Presented and discussed at Saratoga, 1903. Printed in Trans. Am. Soc.  
M. E., Vol. 24 (1903), pp. 921 to 928. (Superseded by Paper 1469)

A tentative report based on the specifications prepared by the American Branch of Committee No. 1 of the International Association for Testing Materials. It was referred back for further action.

Paper 1026

REPORT OF COMMITTEE ON SPECIFICATIONS FOR BOILER PLATE,  
RIVET STEEL, STEEL CASTINGS AND STEEL FORGINGS

Presented and discussed at New York, December 1903. Printed in Trans.  
Am. Soc. M. E., Vol. 25 (1904), pp. 321 to 354. 1 table. (Superseded by  
Paper 1469)

The American Society for Testing Materials was the outgrowth of the International Organization of which the A. S. M. E. was a member. Committee No. 1 of the American Society for Testing Materials prepared a series of specifications, and the present committee was appointed to consider them and submitted a tentative report.

Paper 1034

APPENDIX IV TO SIXTH REPORT OF ALLOYS RESEARCH COMMITTEE,  
BY DR. WILLIAM CAMPBELL

Presented at Chicago, June 1904. Printed in Trans. Am. Soc. M. E.,  
Vol. 25 (1904), pp. 599 to 636. 109 photomicrographs. (30 cents)

This is a summary of various papers handed in by Sir William Roberts-Austen (October 1901), on the effects of strain and of annealing in aluminum, antimony, bismuth, cadmium copper, lead, silver, tin and zinc.

Paper 1054

PRELIMINARY REPORT OF A COMMITTEE TO COÖPERATE IN STAND-  
ARDIZING ABBREVIATIONS, SYMBOLS, PUNCTUATION, ETC.,  
IN TECHNICAL PAPERS

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Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905), pp. 60 to 63. (10 cents)

The committee consists of one member each of the American Society of Civil Engineers, The American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers. The report gives fourteen rules, with a list of examples, which are recommended to the four societies for adoption.

Paper 1055

PRELIMINARY REPORT OF COMMITTEE APPOINTED TO SUGGEST A  
STANDARD TONNAGE BASIS FOR REFRIGERATION

Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905), pp. 64 to 66. (10 cents)

The committee confined itself to a thermal rating and to the establishment of a set of conditions representing good average engineering practice. It considered the selection of units to measure the cooling effect or the refrigeration produced, and the selection of a standard set of conditions under which a refrigerating machine shall be run in determining its commercial tonnage capacity.

Paper 1056

APPENDIX TO REPORT OF COMMITTEE ON STANDARDIZATION OF  
ENGINES AND DYNAMOS

Presented at New York, December 1904. Printed in Trans. Am. Soc.  
M. E., Vol. 26 (1905) p. 67. (10 cents) (See Paper 916)

Recommends that "to facilitate pressing the armature upon the engine shaft,

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the engine builder should reduce the diameter of the shaft beyond the armature fit an amount not less than six thousandths of an inch."

### Paper 1109

#### REPORT OF COMMITTEE APPOINTED TO COÖPERATE WITH THE PENNSYLVANIA RAILROAD SYSTEM IN CONDUCTING TESTS OF LOCOMOTIVES AT THE LOUISIANA PURCHASE EXPOSITION

Presented and discussed at Chattanooga, May 1906. Printed in Trans.  
Am. Soc. M. E., Vol. 27 (1906), pp. 610 to 641, with appendix. 8 tables.  
(20 cents)

The appendix is a brief abstract from "Locomotive Tests and Exhibits, Pennsylvania Railroad System, Louisiana Purchase Exposition" published by the Pennsylvania Railroad, setting forth the results of the tests.

### Paper 1142

#### REVISED REPORT OF COMMITTEE ON STANDARD PROPORTIONS FOR MACHINE SCREWS

Presented at Indianapolis, May 1907. Printed in Trans. Am. Soc. M. E.,  
Vol. 29 (1907), pp. 99 to 122. 1 insert, 14 tables. (20 cents)

The committee's first report was presented at New York, December 1905, and after discussion and amendments again at Chattanooga, and New York (1906). It was accepted at Indianapolis by a unanimous vote of the Society. The report also includes a statement as to the "Automobile Association Standard Bolts and Nuts."

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### Paper 1142A

#### CONDENSED TABULATION OF REPORT OF COMMITTEE ON STANDARD PROPORTIONS FOR MACHINE SCREWS

Presented at Indianapolis, May 1907. Printed in Trans. Am. Soc. M. E.,  
Vol. 29 (1907), pp. 99 to 122. (10 cents)

This is issued on the authority of the committee and contains tables for standard and special screws, standard and special taps, heads and templet gages. One of these tables, reproduced on the following page as Table 1, gives dimensions of standard screws. All dimensions in decimal parts of an inch.

### Paper 1305

#### REPORT OF COMMITTEE ON IDENTIFICATION OF POWER-HOUSE PIPING

Printed in Trans. Am. Soc. M. E., Vol. 33 (1911), p. 17. (10 cents)

The committee recommends distinguishing colors for pipe lines, to be applied to valves, flanges and fittings only.

### Paper 1367

#### REPORT OF SUB-COMMITTEE ON MACHINE SHOP PRACTICE ON DEVELOPMENTS IN MACHINE SHOP PRACTICE DURING THE LAST DECADE

Presented at New York, December 1912. Printed in Trans. Am. Soc.  
M. E., Vol. 34 (1912), pp. 847 to 865. (20 cents)

The principal improvements during the last ten years are reviewed under such



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headings as increased weight of machines, foundations, electric drive, automatic machines, training mechanics, scientific management, standardization of grinding tools, checking systems for small tools, drilling machines, lathes, milling machines, gear making, small tools, etc.

## Paper 1378

### MAJORITY REPORT OF SUB-COMMITTEE ON ADMINISTRATION ON THE PRESENT STATE OF THE ART OF INDUSTRIAL MANAGEMENT

Presented and discussed at New York, December 1912. Printed in Trans. Am. Soc. M. E., Vol. 34 (1912), pp. 1131 to 1229. 3 appendices and minority report. (70 cents)

The committee reviews the conditions leading up to the recent changes. It obtained information from recognized experts and submits a summary statement of this under such headings as labor-saving management, regulative principles of industrial management, the practice of management, statistical data, etc.

TABLE 1 STANDARD SCREWS

Old No.	NEW	OUTSIDE DIAMETERS			PITCH DIAMETERS			ROOT DIAMETERS			THICKNESS OF TEMPLET GAGES
	Outside diam. and threads per inch	Minimum	Maximum	Difference	Minimum	Maximum	Difference	Minimum	Maximum	Difference	
0	.060-80	.0572	.060	.0028	.0505	.0519	.0014	.0410	.0438	.0028	.161
1	.073-72	.0700	.073	.0030	.0625	.0640	.0015	.0520	.0550	.0030	.166
2	.086-64	.0828	.086	.0032	.0743	.0759	.0016	.0624	.0657	.0033	.172
3	.099-56	.0955	.099	.0035	.0857	.0874	.0017	.0721	.0758	.0037	.180
4	.112-48	.1082	.112	.0038	.0966	.0985	.0019	.0807	.0849	.0042	.192
5	.125-44	.1210	.125	.0040	.1082	.1102	.0020	.0910	.0955	.0045	.199
6	.138-40	.1338	.138	.0042	.1197	.1218	.0021	.1007	.1055	.0048	.208
7	.151-36	.1466	.151	.0044	.1308	.1330	.0022	.1097	.1149	.0052	.218
8	.164-36	.1596	.164	.0044	.1438	.1460	.0022	.1227	.1279	.0052	.218
9	.177-32	.1723	.177	.0047	.1544	.1567	.0023	.1307	.1364	.0057	.231
10	.190-30	.1852	.190	.0048	.1660	.1684	.0024	.1407	.1467	.0060	.239
12	.216-28	.2111	.216	.0049	.1904	.1928	.0024	.1633	.1696	.0063	.249
14	.242-24	.2368	.242	.0052	.2123	.2149	.0026	.1808	.1879	.0071	.271
16	.268-22	.2626	.268	.0054	.2358	.2385	.0027	.2014	.2090	.0076	.285
18	.294-20	.2884	.294	.0056	.2587	.2615	.0028	.2208	.2290	.0082	.303
20	.320-20	.3144	.320	.0056	.2847	.2875	.0028	.2468	.2550	.0082	.303
22	.346-18	.3402	.346	.0058	.3070	.3099	.0029	.2649	.2738	.0089	.324
24	.372-16	.3660	.372	.0060	.3284	.3314	.0030	.2810	.2908	.0098	.350
26	.398-16	.3920	.398	.0060	.3544	.3574	.0030	.3070	.3168	.0098	.350
28	.424-14	.4178	.424	.0062	.3745	.3776	.0031	.3204	.3312	.0108	.384
30	.450-14	.4438	.450	.0062	.4005	.4036	.0031	.3464	.3572	.0108	.384

## Paper 1394

### REPORT OF COMMITTEE ON STANDARDIZATION OF CATALOGUES ON STANDARD SIZES OF CATALOGUES

Presented at Baltimore, 1913. Printed in Trans. Am. Soc. M. E., Vol. 35 (1913), pp. 269 to 274. (10 cents)

The committee recommends standard sizes for index cards, folders, catalogues, paper boxes, filing boxes and cabinets.

**DATA ON A. S. M. E. STANDARDS**

**Paper 1398**

**REPORT OF SUB-COMMITTEE ON FIRE PROTECTION ON STANDARD  
THREADS FOR HOSE COUPLINGS**

Presented at New York, December 1913. Printed in Trans. Am. Soc.  
M. E., Vol. 35 (1913), pp. 301 to 307. (10 cents)

(NATIONAL STANDARD)

The committee has formulated specifications for 2 $\frac{1}{2}$ -, 3-, 3 $\frac{1}{2}$ - and 4-in. hose couplings, and for converting non-standard couplings.

**Paper 1399**

**REPORT OF COMMITTEE ON STANDARDIZATION OF PIPE-THREAD  
GAGES**

Presented at New York, December 1913. Printed in Trans. Am. Soc.  
M. E., Vol. 35 (1913), pp. 309 to 311. 1 table. (10 cents)

The purpose of the committee was to fix manufacturing limits for the use of the Briggs standard pipe-thread gages when tapping fittings or flanges, so that pipe cut to the Briggs standard might always enter a definite number of turns. A table of sizes and tolerances is given.

**Paper 1403**

**REPORT OF SUB-COMMITTEE ON HOISTING AND CONVEYING**

Presented and discussed at New York, December 1913. Printed in Trans.  
Am. Soc. M. E., Vol. 35 (1913), pp. 405 to 416. (10 cents)

712 The committee reviews developments in hoisting and conveying, and makes preliminary recommendations as to boilers, electric equipment, safety, foundations, depreciation, wheels, brakes, wire rope, ethics.

**Paper 1429**

**REPORT OF COMMITTEE ON CODE OF ETHICS**

Recommended by letter ballot of the membership of the Society. Reported at St. Paul, Minneapolis, June 1914. Printed in Trans. Am. Soc.  
M. E., Vol. 36 (1914), pp. 23 to 27. (10 cents)

The committee's recommendations deal with general principles, engineers' relations to client or employer, ownership of engineering records and data, engineers' relations to the public and to the engineering fraternity.

**Paper 1430**

**REPORT OF COMMITTEE ON STANDARDIZATION OF FLANGES ON THE  
AMERICAN STANDARD FOR PIPE FLANGES, FITTINGS AND  
THEIR BOLTING**

*Including Schedule of Standard Pipe Flanges and Fittings from 1  
In. to 100 In., 125 Lb. Working Pressure, and Schedule  
of Extra Heavy Pipe Flanges and Fittings from  
1 In. to 48 In., 250 Lb. Working Pressure*

Presented at New York, December 1913, and subsequently revised.  
Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 29 to 57. 4 tables,  
32 figs. Recommended to become effective January 1, 1914, and revised to  
March 7 and 20, 1914. (40 cents)

The American Standard is a compromise between the 1912 U. S. Standard and the Manufacturers' Standard adopted in 1912, and combines the advantages

## DATA ON A. S. M. E. STANDARDS

of both. The standard-weight or low-pressure sizes have been extended from 30 in. to 100 in., and the extra heavy or high-pressure sizes from 24 in. to 48 in.

### Paper 1448

#### REPORT OF SUB-COMMITTEE ON RAILROADS ON STEAM LOCOMOTIVES OF TODAY

Presented and discussed at New York, December 1914. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 483 to 534. (40 cents)

This report and discussion is devoted to the progress of the steam locomotive, especially during the ten years since the Louisiana Purchase Exposition tests reported in Paper 1109.

### Paper 1450

#### REPORT OF THE COMMITTEE ON RESOLUTIONS OF THE SNOW REMOVAL CONFERENCE HELD IN PHILADELPHIA, APRIL 16 AND 17, 1914

Presented and discussed at New York, December 1914. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 551 to 569.

The committee reviews the methods adopted for the removal of snow, deals with the particular cases of Philadelphia, New York, Boston, Scranton, the Public Service Railway Company of New Jersey and the Pennsylvania Railroad Company, and in conclusion makes eight recommendations on the subject.

### Paper 1468

#### REPORT OF COMMITTEE ON STANDARD CROSS-SECTIONS AND SYMBOLS

Presented and discussed at New York, December 1914. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 965 to 976. 2 figs. (10 cents)

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The committee recommends a standard method of indicating materials in cross-section and submits cross-sections for 19 materials.

### Paper 1469

#### REPORT OF COMMITTEE<sup>1</sup> TO FORMULATE STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF STEAM BOILERS AND OTHER PRESSURE VESSELS AND FOR THEIR CARE IN SERVICE

Presented at New York, December 1914. Approved by the Council Feb. 13, 1915. Printed in Trans. Am. Soc. M. E., Vol. 36 (1914), pp. 977 to 1086. 16 tables, 30 figs. and 4 indexes. (80 cents paper, \$1.60 cloth)

The committee was appointed on September 15, 1911, and submits its final report, the primary object of which is to secure safe boilers. When the report was accepted, the Boiler Code Committee was reappointed as a permanent committee and now meets monthly for the purpose of considering communications relative to the Boiler Code. The results are published in MECHANICAL ENGINEERING each month. The following is a résumé of the contents of the Boiler Code:

New Installations

Power Boilers

Specifications for Boiler Plate Steel, Boiler Rivet Steel, Staybolt Steel, Steel Castings, Gray Iron Castings, Malleable Castings, Boiler Rivet Iron, Staybolt Iron, Refined Wrought-Iron Bars, Boiler Tubes

Heating Boilers

Existing Installations

Appendix

Efficiency of Joints, Braced and Stayed Surfaces, Safety Valves, Fusible Plugs.

<sup>1</sup> The Boiler Code Committee.

# DATA ON A. S. M. E. STANDARDS

## Paper 1474

### REPORT OF COMMITTEE ON STANDARDIZATION OF SPECIAL THREADS FOR FIXTURES AND FITTINGS, ON ROLLED THREADS FOR SCREW SHELLS OF ELECTRIC SOCKETS AND LAMP BASES

Presented at Buffalo, N. Y., June 1915. Printed in Trans. Am. Soc. M. E.,  
Vol. 37 (1915), pp. 25 to 29. 4 figs. (See also Paper 1525.) (10 cents)

The report gives standard dimensions of socket screw shells and lamp-base screw shells for miniature, candelabra, medium and mogul sizes, go and not-go.

## Paper 1523

### REPORT OF SUB-COMMITTEE ON MACHINE SHOP PRACTICE ON SAFETY CODE FOR THE USE AND CARE OF ABRASIVE WHEELS

Presented and discussed at New York, December 1913. Printed in Trans.  
Am Soc. M. E., Vol. 37 (1915), pp. 1221 to 1230. 4 tables. (10 cents)

In nearly all vital points a code recommended by the Abrasive Wheel Manufacturers was approved, and forms the basis of the present code. The safety devices are considered under the three general heads: protection flanges, protection hoods and protection chucks.

Table 2, giving revolutions per minute for various sizes of grinding wheels to give the peripheral speed in feet per minute, is included in this report.

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TABLE 2 R. P. M. FOR VARIOUS SIZES OF GRINDING WHEELS TO GIVE  
PERIPHERAL SPEED IN FT. PER MIN.

Diam. of Wheel in In.	4,000	4,500	5,000	5,500	6,000	6,500
1	15,279	17,200	19,099	21,000	22,918	24,850
2	7,639	8,590	9,549	10,500	11,459	12,420
3	5,093	5,725	6,366	7,000	7,639	8,279
4	3,820	4,295	4,775	5,250	5,730	6,205
5	3,056	3,440	3,820	4,200	4,584	4,970
6	2,546	2,865	3,183	3,500	3,820	4,140
7	2,183	2,455	2,728	3,000	3,274	3,550
8	1,910	2,150	2,387	2,635	2,885	3,100
10	1,528	1,720	1,910	2,100	2,292	2,485
12	1,273	1,453	1,592	1,750	1,910	2,070
14	1,091	1,228	1,364	1,500	1,637	1,778
16	955	1,075	1,194	1,314	1,432	1,552
18	849	1,061	1,061	1,167	1,273	1,386
20	764	860	957	1,050	1,146	1,241
22	694	782	868	952	1,042	1,128
24	637	716	796	876	955	1,035
26	586	661	733	809	879	955
28	546	614	683	749	819	887
30	509	573	637	700	764	827
32	477	537	596	657	716	776
34	449	506	561	618	674	730
36	424	477	531	584	637	689
38	402	453	503	553	603	653
40	382	430	478	525	573	621
42	364	409	455	500	546	591
44	347	391	434	477	521	564
46	332	374	415	456	498	539
48	318	358	397	438	477	517
50	306	344	383	420	459	497
52	294	331	369	404	441	487
54	283	318	354	389	425	469
56	273	307	341	366	410	443
58	264	296	330	354	396	428
60	255	277	319	350	383	414

# DATA ON A. S. M. E. STANDARDS

## Paper 1525

### REPORT OF COMMITTEE ON STANDARDIZATION OF SPECIAL THREADS FOR FIXTURES AND FITTINGS, ON STRAIGHT PIPE THREADS

Presented at New York, December 1915. Printed in Trans. Am. Soc. M. E., Vol. 37 (1915), pp. 1263 to 1272. 5 tables, 3 figs. (See also Paper 1474.) (10 cents)

This report recommends standards for outside, pitch, and root diameters and tolerances of straight pipe threads. The proportions recommended are shown in Fig. 2 and in Table 3.

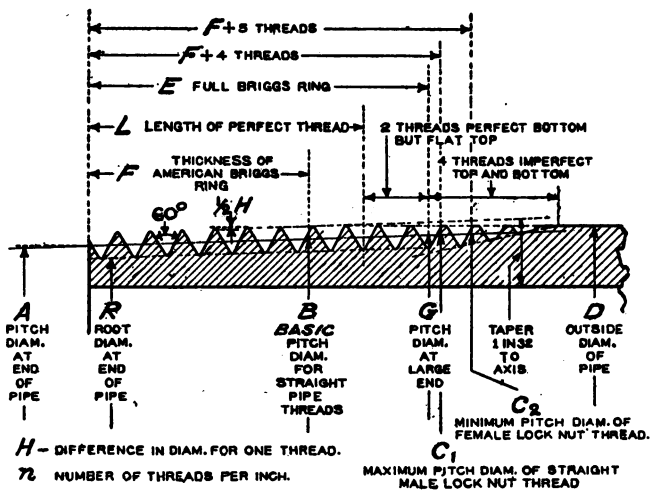


FIG. 2 BASIC STRAIGHT PIPE SIZES

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## Paper 1526

### REPORT OF POWER TEST COMMITTEE ON RULES FOR CONDUCTING PERFORMANCE TEST OF POWER PLANT APPARATUS

Presented at New York, December 1915. Printed in Trans. Am. Soc. M. E., Vol. 37 (1915), pp. 1273 to 1458. 22 tables, 27 figs., 38 appendices, Index. (Supercedes all previous codes for testing power-plant apparatus) (\$1.40 paper, \$2.00 cloth)

#### (POWER TEST CODE)

The following is a résumé of the contents of the Power Test Code:

#### General Matters

- 1 Instructions regarding tests, object, preparations, miscellaneous instructions, operating conditions, records, plotting data and curves, report

TABLE AMERICAN BRIGGS PIPE STANDARD LOCK-NUT THREADS AND BASIC STRAIGHT PIPE SIZES

Pipe Size In.	Threads per In.	Depth Thread $\frac{0.8}{n}$	Pitch Diameter of Pipe	Pitch Diameter at Notch Base Straight	Maximum Pitch Diameter Male Lock-nut Thread $C_1$	Minimum Pitch Diameter Outside Female Lock-nut Thread $C_2$	Outside Diameter Pipe $D$	Thickness Full Briggs Ring $E$	Inches Thickness Briggs Ring $F$	Pitch Diameter at Large End $G$	Difference in Diameter One Thread $H$
	$n$		$A$	$B$	$C_1$	$C_2$	$D$	$E$	$F$	$G$	$H$
$1\frac{1}{8}$	27	0.02962	0.36350	0.37475	0.38400	0.38632	0.405	0.2638	0.180	0.37999	0.00232
$1\frac{1}{4}$	18	0.04444	0.47739	0.48989	0.50378	0.50725	0.540	0.4018	0.200	0.50250	0.00347
$1\frac{1}{2}$	14	0.05714	0.61201	0.62701	0.64090	0.64437	0.675	0.4078	0.240	0.63750	0.00347
$1\frac{3}{4}$	11	0.07273	0.75843	0.77843	0.79628	0.80075	0.840	0.5377	0.320	0.79179	0.00446
$2$	8	0.12500	0.96768	0.98886	1.00671	1.01118	1.050	0.5437	0.339	1.00179	0.00446
$2\frac{1}{2}$	6	0.16667	1.21363	1.23863	1.26036	1.26580	1.315	0.6828	0.400	1.25630	0.00543
$3$	5	0.20000	1.55713	1.58338	1.60511	1.61055	1.660	0.7088	0.420	1.60132	0.00543
$3\frac{1}{2}$	4	0.25000	1.79609	1.82234	1.84407	1.84951	1.900	0.7355	0.436	1.84131	0.00543
$4$	3	0.33333	2.26902	2.29627	2.31801	2.32344	2.375	0.7565	0.436	2.31630	0.00543
$4\frac{1}{2}$	2	0.50000	2.71954	2.76216	2.79341	2.80122	2.875	0.766	0.436	2.79063	0.00781
$5$	1	1.00000	3.34063	3.38850	3.42006	3.42756	3.500	0.821	0.766	3.41563	0.00781
$5\frac{1}{2}$	8	0.12500	3.83750	3.8881	3.92006	3.92787	4.000	1.2500	0.844	3.91563	0.00781
$6$	8	0.12500	4.33438	4.38713	4.41838	4.42619	4.500	1.3500	0.875	4.41563	0.00781
$6\frac{1}{2}$	8	0.12500	4.83125	4.88593	4.91718	4.92499	5.000	1.4063	0.937	4.91563	0.00781
$7$	8	0.12500	5.39074	5.44930	5.48055	5.48536	5.563	1.5125	1.000	5.47863	0.00781
$7\frac{1}{2}$	8	0.12500	6.4610	6.50597	6.53722	6.54503	6.625	1.6125	1.063	6.54063	0.00781
$8$	8	0.12500	7.43985	7.50235	7.53360	7.54141	7.625	1.7125	1.130	7.54063	0.00781
$8\frac{1}{2}$	8	0.12500	8.43360	8.50003	8.53128	8.53909	8.625	1.8125	1.210	8.54063	0.00781
$9$	8	0.12500	9.42735	9.49797	9.52922	9.53703	9.625	1.9125	1.210	9.54063	0.00781
$10$	8	0.12500	10.54532	10.62094	10.65219	10.66000	10.750	1.9250	1.210	10.66563	0.00781

## DATA ON A. S. M. E. STANDARDS

- 2 Standards relating to capacity, efficiency and economy
- 3 Rules for sampling and drying coal and ash, and sampling steam and gases
- Individual Codes
  - 4 Boiler code
  - 5 Reciprocating steam engine code
  - 6 Steam turbine code
  - 7 Pumping machinery code
  - 8 Code for compressors, blowers, fans
  - 9 Code for complex steam power plant
  - 10 Locomotive codes
  - 11 Gas producer code
  - 12 Gas and oil engine code
  - 13 Waterwheel code
- Appendices.

### Paper 1572

#### REPORT OF SUB-COMMITTEE ON PROTECTION OF INDUSTRIAL WORKERS, ON CODE OF SAFETY STANDARDS FOR CRANES

Presented at New York, December 1916. Printed in Trans. Am. Soc. M. E., Vol. 38 (1916), pp. 1205 to 1212. 1 fig. (10 cents)

The standards in this report apply to cranes which are regularly used in and form part of a permanent industrial plant. In addition to electric traveling cranes, the regulations cover jib cranes, monorail cranes, hand-power cranes and other hoisting apparatus of a similar nature, insofar as the various sections apply.

The report contains twenty recommendations on general construction, twenty-two rules for operators, six rules for floormen and six rules for repairmen. It also includes an illustrated code of manual signals for crane operation.

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## IV CONCISE LIST OF A. S. M. E. STANDARDS

The Standards listed below are those which are now of general interest and are presented in the following form convenient for reference.

**Standards for Graphic Presentation.** Preliminary Report of Joint Committee composed of representatives of seventeen associations with the A. S. M. E. (August 1915 Journal). Paper 101X.

**Standard Pipe and Pipe Threads.** Submitted at the Seventh Annual Meeting, held in New York City, November 29 to December 3, 1886. Paper 226.

**Standard Abbreviations, Symbols, Punctuation, Etc., in Technical Papers.** Presented at the New York Meeting (December 1904). Paper 1054.

**Standard Proportions for Machine Screws.** This final Report of the Committee on Standard Proportions for Machine Screws was accepted at the Indianapolis Meeting (May 1907) and establishes a series of fine-thread screws from  $\frac{1}{2}$  in. down. Papers 1142 and 1142A.

**Standard Sizes of Catalogues.** Presented at the Spring Meeting, Baltimore, 1913, and later revised. Paper 1394.

**Standard Threads for Hose Couplings.** Presented at the Annual Meeting, 1913. Defines specifications for  $2\frac{1}{2}$ -in. to 4-in. couplings. Paper 1398.

**Standards of Pipe Thread Gages.** Presented at the Annual Meeting 1913. Paper 1399.

## DATA ON A. S. M. E. STANDARDS

**American Standard for Pipe Flanges, Fittings and Bolting.** Presented at the Annual Meeting, New York, 1913, and subsequently revised. Paper 1430.

**Standard Cross-Sections and Symbols.** Presented at the Annual Meeting December 1914. Paper 1468.

**A. S. M. E. Boiler Code.** Rules for the Construction of Stationary Boilers and for Allowable Working Pressures; Report of the Committee to Formulate Standard Specifications for the Construction of Steam Boilers and Other Pressure Vessels and for Their Care in Service. The Rules are divided in two parts. Part 1 applies to new installations, Power Boilers, Heating Boilers. Part 2 applies to existing installations. Submitted to the Council December 3, 1918. Paper 1469.

**Standards of Special Threads for Fixtures and Fittings.** Rolled Threads for Screw Shells of Electric Sockets and Lamp Bases. Presented at the Spring Meeting, Buffalo, N. Y., June 1915. Paper 1474.

**Standards of Special Threads for Fixtures and Fittings; Straight Pipe Threads for Fixtures.** Presented at the Annual Meeting, December 1915. Paper 1525.

**Power Test Codes.** Rules for Conducting Performance Tests of Power Plant Apparatus, embracing 1 Boilers, 2 Reciprocating Steam Engines, 3 Steam Turbines, 4 Pumping Machinery, 5 Compressors, Blowers and Fans, 6 Complete Steam Power Plants, 7 Locomotives, 8 Gas Producers, 9 Gas and Oil Engines, 10 Waterwheels. Now undergoing process of revision, 18 new codes to be published separately. Will be ready in from 6 to 18 months. Printed December 1915. Paper 1526.

**Recommended Practice for Standardization of Filters.** Presented at the Annual Meeting, December 1916. Paper 1600.

**American Standard for Pipe Flanges, Fittings and Bolting.** Presented at the Annual Meeting, December 1918. Low-Pressure Standard (50 lb.) Hydraulic Standard (800 lb., 1200 lb., 3000 lb.). Paper 1654.

## SAFETY CODES

**Standardization of Safety Principles.** A paper dealing in a general way with Industrial Safety Standards. Presented at the Annual Meeting, December 1915. Paper 1510.

**Safety Code for the Use and Care of Abrasive Wheels.** Presented at the Annual Meeting, December 1915. Paper 1523.

**Code of Safety Standards for Cranes.** Presented at the Annual Meeting, December 1916. Covers construction and operation of electric traveling cranes. Paper 1572.

**Code of Safety Standards for Industrial Ladders.** Presented at the Spring Meeting, Cincinnati, Ohio, May 1917. Paper 1597.

**Code of Safety Standards for Power-Transmission Machinery.** Presented at the Spring Meeting, Cincinnati, Ohio, May 1917. Paper 1598.

**Code of Safety Standards for Woodworking-Machine Guards.** Presented at the Annual Meeting, December 1917. Paper 1631.



**DATA SECTION  
PART II**

**Engineering Data**

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**Pages 721-764**

On the following pages are engineering data selected from the TRANSACTIONS, Volume 40, 1918, and from THE JOURNAL of the American Society of Mechanical Engineers for the year 1918.

The material from the TRANSACTIONS includes original data derived by the authors of papers presented to the Society and embodied in those papers.

The data from THE JOURNAL are taken from the Engineering Survey Section, which includes abstracts from domestic and foreign periodicals and society publications, and the source of information is given in each instance.

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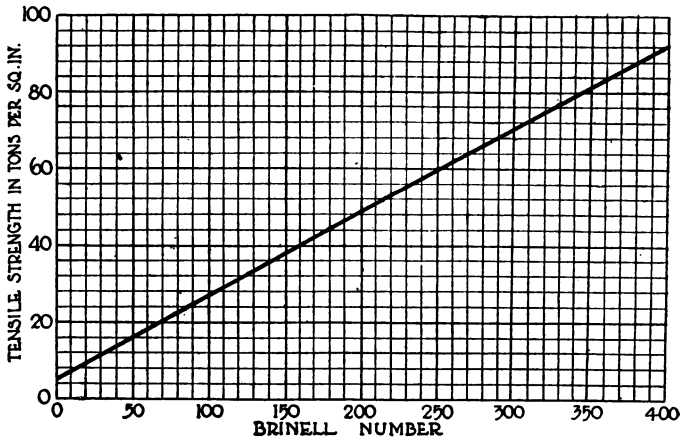


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### WIRE ROPE FOR AIRCRAFT

A certain amount of hardness is desirable in wire for wire rope because a hard-drawn wire of given size will support a heavier load than untreated steel, but increased tenacity is obtained at the expense of elasticity and may be carried to the point where the material becomes dangerously brittle. Fig. 1 shows how hardening the material raises its tensile strength. The relation between Brinell hardness numbers and the tensile strength of drawn steel is expressed by the following equation:

$$\text{Tensile strength, tons per sq. in.} = (0.213 \times \text{Brinell number}) + 5.$$



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FIG. 1 CURVE SHOWING TENSILE STRENGTH AS A FUNCTION OF BRINELL HARDNESS

[*Journal*, April 1918, pp. 344-345]

[Source: *Aeronautical Engineering*, January 9, 1918]

### AIRCRAFT-ENGINE EVOLUTION

TABLE 1 AIRCRAFT-ENGINE EVOLUTION

	Year	Horse-power	Weight, lb.	Weight per horse-power lb.
Langley-Manly engine.....	1901	52	151	2.9
Original Wright Bros.....	1903	12	152	12.7
Improved Wright Bros.....	1904	16	180	11.4
Improved Wright Bros.....	1905	19	180	9.5
Redesigned Wright Bros.....	1908	35	182	5.5
Average on market.....	1910	54	309	5.7
Wolsley engine.....	1913	147	720	4.9
Average on market.....	1914	112	437	3.9
Average on market.....	1915	133	512	3.8
Average on market.....	1916	185	570	3.1
Average on market.....	1917	243	693	2.8
Liberty 12-cylinder.....	1917	400	801	2.0
Liberty 12-cylinder (March).....	1918	432	808	1.9
Liberty 12-cylinder (May).....	1918	460	825	1.8

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The average consumption of fuel decreased from about 0.8 lb. per hp-hr. in 1903 to about 0.65 lb. in 1914, since which it has slowly dropped to about 0.55 lb. in 1918, and for the Liberty to 0.50 lb. The present Liberty consumption is approximately 0.46 lb. per hp-hr. Table 1 shows the advance in the average power-weight ratio by years for the engines in actual flying use.

[*Journal, July 1918, p. 579*]

[Source: War Department, *The Official Bulletin*, June 12, 1918]

### TESTS ON ROTARY BLOWERS AND EXHAUSTERS

Determination of effect of pressure drop due to friction in the intake pipe and of actual and probable delivery with varying speeds. Tests on rotary exhausters are seldom performed, partly because their discharge is pulsating and therefore nozzles or orifices can not be used to measure the flow directly, and also because the rotary exhauster is in itself a meter of the displacement type, its speed being the measure of the quantity of gas delivered. Usually the probable delivery is found by multiplying the difference between the slip speed and the actual speed

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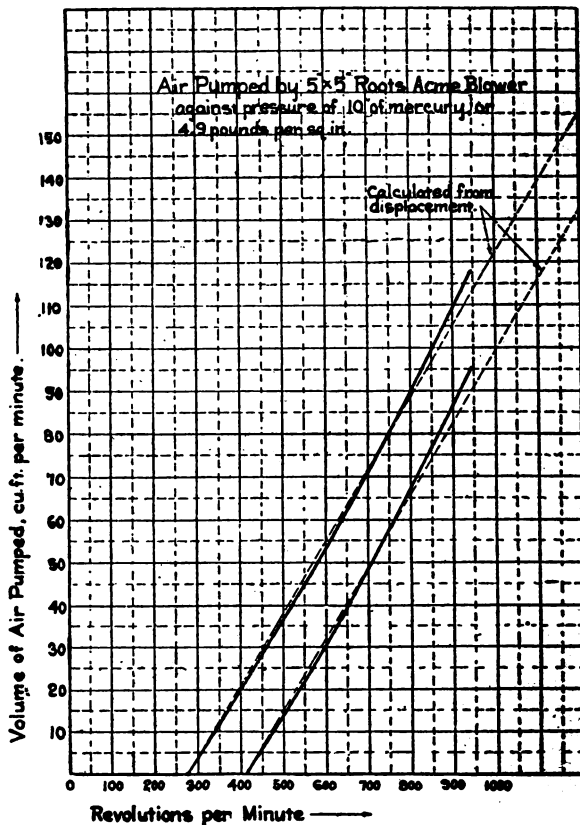


FIG. 2 RELATION BETWEEN QUANTITY OF AIR DELIVERED AND SPEED OF BLOWER

## ENGINEERING DATA

by the displacement of the exhauster per revolution. The chart in Fig. 2 shows the results of tests on the delivery of a Roots rotary blower. The curves show that the actual delivery falls below the probable delivery at lower speeds and rises above it at higher speeds, due probably to vibrations of the air column. As regards these vibrations, it is stated that they have a phase lag against the impressed vibration of the blower, which may explain why attempts to furnish an engine torque of the blower have not been successful.

[*Journal*, August 1918, pp. 716-717]

[Source: W. Trinks, *The Blast Furnace and Steel Plant*, July 1918, pp. 298-299]

### DROP OF PRESSURE IN COMPRESSED-AIR HOSE

Tests were made to obtain the drop in pressure on 50-ft. lengths of air-drill hose of  $\frac{3}{4}$ -in. and 1-in. diameter. The drop in pressure through the fittings alone was negligible. Fig. 3 gives results for  $\frac{3}{4}$ -in. hose.

Hose with the most "give" has the least drop in pressure, because when under pressure the diameter is slightly increased. Wire-wound hose is very rigid, and often corrugated by the tight winding, thus increasing friction and constricting the opening.

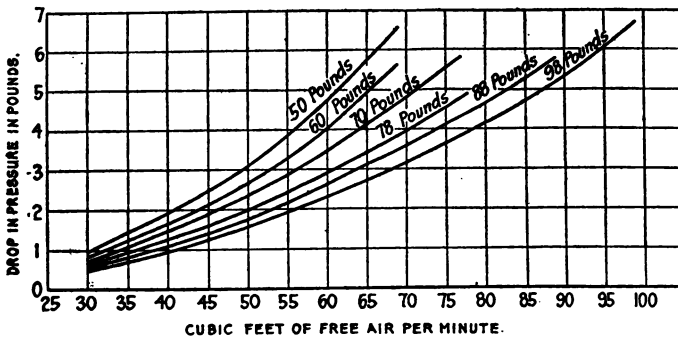


FIG. 3 DROP IN PRESSURE IN WOVEN HOSE AGAINST AIR DELIVERED AT DIFFERENT PRESSURES

[*Journal*, January 1918, p. 104]

[Source: W. S. Weeks, *Western Engineering*, November 1917, pp. 434-435]

### DESIGN OF AIR DUCTS

The difference in pressure (loss in static head), necessary to pass air through a duct, assumed to be of round or square sheet metal, expressed in inches of water, is shown by the formula

$$H = [a + b + (c/39)]H_v$$

where

$H$  = loss in static head.

$H_v$  = velocity head.

$a$  = number of right-angle turns.

$b$  = number of abrupt reductions in area.

$c$  =  $\frac{\text{length of duct}}{\text{diameter of duct}}$

[*Journal*, May 1918, p. 423]

[Source: E. Knowlton and E. H. Freiburghouse, *General Electric Review*, April 1918, pp. 240-246]

### ORIENTATION OF SAWTOOTH BUILDINGS AND SLOPE OF LIGHTING AREA AS RELATED TO REQUIREMENTS OF LEAST DIRECT SUNLIGHT

The amount of direct sunlight admitted daily, its time of admission, and its duration are dependent upon

- a* The day of the year, determining as it does the sun's path across the sky.
- b* The direction in which the lighting area faces as regards the points of the compass.
- c* The slope of the lighting area.

The position of the sun at any given time depends upon the latitude of the place, time of day, the calendar date, and may be obtained from standard altitude and azimuth tables. Knowing this, the time of admission and duration of direct sunlight for any day of the year may be calculated as follows:

In Fig. 4 let the plane determined by the three points, *A*, *C*, and *D* represent the lighting-area plane, and let points *A*, *B*, and *E* define a plane parallel with the horizon. These two planes intersect in line *AF*. The acute angle *v* is then

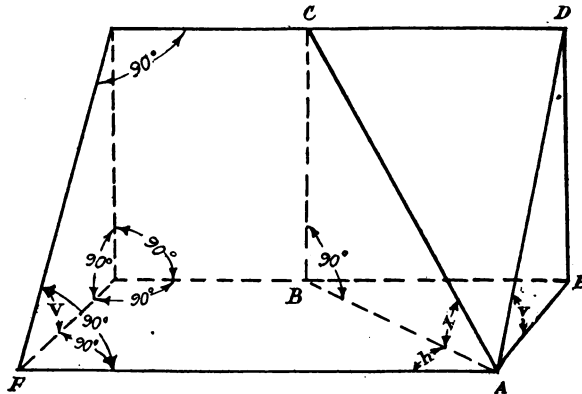


FIG. 4 TO ILLUSTRATE ADMISSION AND DURATION OF DIRECT SUNLIGHT

the effective slope or vertical angle of the lighting-area plane. Also let line *AB* represent the horizontal direction or bearing of the sun with respect to the building at any assumed calendar data and time. That is, angle *h* = the difference between the sun's true bearing or azimuth and the true corrected bearing or azimuth of the lighting-area ridges, each azimuth being read easterly or westerly from north, according to whether morning or afternoon conditions are being computed.

Now pass plane *ABC* through *AB* perpendicular to plane *ABE*, cutting the lighting-area plane *ACD* in line *CD*. By construction this plane also contains the sun's altitude line through point *A*. Consequently, it is evident that if vertical angle *x* is greater than the altitude of the sun, a condition of total shade exists within the building at the given time. And contrariwise, if *x* is less than the solar altitude, the sun is in front of the plane of the lighting area and some direct sunlight is entering the building.

Expressed in terms of *v* and *h* (see Fig. 4), *x* may be found from the equation:

$$\tan x = \sin h \tan v$$



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From this equation exact information may be obtained as to the time of admission of direct sunlight and the number of hours of its duration.

Table 2 gives in convenient form different values of  $x$  for assumed values of  $h$ . Its use makes unnecessary any reference to trigonometrical tables, unless closer results are desired, for angles not given.

TABLE 2 SHOWING VALUES OF ( $x$ ) IN TERMS OF ( $h$ ) AND ( $\varphi$ )

$h^\circ$	$x$ for $\varphi = 70^\circ$	$x$ for $\varphi = 75^\circ$	$x$ for $\varphi = 78^\circ$	$x$ for $\varphi = 80^\circ$
3	8° 11'	11° 03'	13° 50'	16° 30'
5	13° 28'	17° 59'	22° 18'	26° 16'
7	18° 29'	24° 28'	29° 52'	34° 36'
10	25° 30'	32° 57'	39° 24'	44° 32'
15	35° 28'	44° 01'	50° 40'	55° 44'
20	43° 15'	51° 55'	61° 05'	62° 43'
25	49° 15'	57° 36'	63° 20'	67° 22'
30	53° 59'	61° 49'	66° 59'	70° 34'
35	57° 36'	64° 58'	69° 41'	72° 56'
40	60° 30'	67° 22'	71° 42'	74° 40'
50	64° 36'	70° 43'	74° 30'	77° 03'
60	67° 15'	72° 48'	76° 12'	78° 30'
70	68° 49'	74° 05'	77° 18'	79° 22'
80	69° 44'	74° 47'	77° 50'	79° 52'
90	70° 0'	75° 0'	78° 0'	80° 0'

[W. S. Brown, *Trans.*, vol. 40, pp. 604-609]

### MEASURING AIR DELIVERED BY TURBO-BLOWER

The combination of a standard orifice and a pitot tube is recommended. The standard orifice may be placed in the end of the intake pipe directly under the hood and the pitot tube used to measure the velocity of the air leaving the orifice. The length of the intake pipe has no influence on the measurements. If the orifice diameter bears the proper relation to the pipe diameter the loss in pressure is negligible. Carnot gave an equation for this loss as follows:

$$\text{Lost head} = \frac{(V_2 - V_1)^2}{2g}$$

where

$V_1$  = velocity of fluid in pipe, ft. per sec.

$V_2$  = velocity of fluid in orifice, ft. per sec.

$g$  = acceleration due to gravity, ft. per sec.

and the lost head is in feet of the fluid being measured. This equation gives fairly close results. From the range of velocities used in the test, the variation of the actual and calculated loss did not exceed 7 per cent. If an orifice diameter of about six-tenths of the pipe diameter is used, and the lost head reduced to actual additional horsepower required to drive the turbo-blower, it is found that it amounts to less than one-half of one per cent.

[*Journal*, January 1918, p. 104]

[Source: Thomas G. Estep, Jr., *The Blast Furnace and Steel Plant*, December 1917, pp. 558-559]

### ANNEALING BY MUFFLE AND POT OVENS COMPARED

Tests to determine carbon losses in these two methods of treating malleable iron. In the matter of annealing temperatures for malleable iron much depends on the chemical composition of the hard iron. It is often desirable to run the temperature considerably higher than 1400 deg. fahr., the maximum and mini-

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imum temperatures of annealing being in the case of pot ovens 1650 and 1450 deg., and in the case of muffle ovens 1700 and 1500 deg., respectively. Exhaustive tests have shown that prolonged annealing has no detrimental effect on the physical strength of the product unless the temperature is run too high, and it is safe to say that more poor malleable iron is produced by underannealing than by overannealing.

TABLE 3 COMPARATIVE RESULTS ON POT-OVEN AND MUFFLE-OVEN ANNEALING

	Pot Oven		Muffle Oven
	Mild packing	Strong packing	Without packing
Total carbon in hard iron, per cent.....	2.63	2.63	2.63
Combined carbon after anneal, per cent.....	0.53	0.13	0.05
Graphic carbon after anneal, per cent.....	1.75	1.85	2.12
Total carbon after anneal, per cent.....	2.28	1.98	2.17
Total carbon removed in anneal, per cent...	0.35	0.65	0.46
Wedge test, length of butt in inches.....	2 $\frac{3}{4}$	2 $\frac{3}{4}$	2
Tensile strength, lb. per sq. in.....	49,448	50,044	49,542
Elastic limit, lb. per sq. in.....	38,746	37,122	37,398
Elongation, per cent in 2 in.....	6.3	6.7	7.3

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The principle advantages in favor of the muffle oven are claimed to be: Elimination of labor required to pack, handle and shake out the pots; cost of packing material; expense of renewing pots, etc. The disadvantages: Longer time required to bring the casting to annealing temperature; castings are more apt to become warped or distorted. There is more danger of the castings becoming scaled due to the air leakage into the muffle and finally, small and delicately constructed castings cannot be annealed in this type of oven at all, unless they are packed in trays.

[*Journal*, May 1918, pp. 430-431]

[Source: J. B. Deisher, *The Foundry*, April 1918, pp. 154-158]

### THE RELATIVE MERITS OF CASE-HARDENING MATERIALS

Case-hardening may be said to consist of two parts: (1), carburizing the steel shell about the low-carbon soft steel; and (2) hardening this carburized shell by quenching when at a high heat. The difficult part of the problem is to find a case-hardening material best apt to give up its carbon to the steel. The object of tests is to find a material which will give the deepest, densest and most uniform case under constant conditions of time, temperature, packing and quenching.

The following method of test is employed by the Remington Typewriter Works: Test pieces, 3 $\frac{1}{2}$  in. long and 1 $\frac{1}{16}$  in. in diameter, were cut from a bar of round, bright machine-screw steel and packed in boxes, two pieces in each box. The box was completely filled with the case-hardening material and the cover sealed with fireclay. The materials tested were charcoal and potassium ferrocyanide, and granulated bone. After the specimens were placed in the furnace the temperature was raised until it reached 1800 deg. fahr. about one hour later, after which it was cut down to, and held at, approximately, 1600

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deg. fahr. On removal the test pieces were quenched in cold water. They were then sawed in two and the cut end of one of the pieces ground flat, highly polished and etched with a 20 per cent solution of nitric acid. Two lines perpendicular to one another were then scribed on this polished surface, the depth of these lines, to a certain extent, indicating the hardness of the case. Fig. 5 shows the results of measurements with the two case-hardening materials.

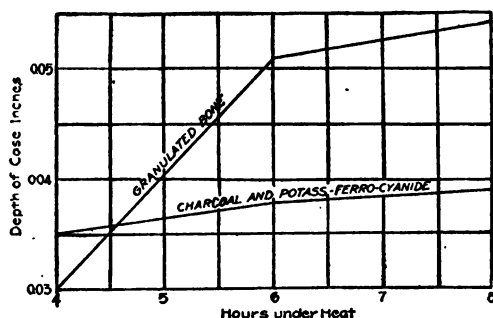


FIG. 5 RESULTS OF TESTS ON CASE-HARDENING MATERIALS

[*Journal*, November 1918, pp. 968-969]

[Source: C. N. Underwood, *American Machinist*, September 26, 1918, pp. 569-571]

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## TEMPERING AND COLD-WORKING OF CARBON STEEL

Heat changes brought about in annealing cold-worked or heat-treated steel exhibit a complete parallelism between these two phenomena.

The following results were obtained by careful and delicate experiments:

1 The curve of the rise of temperature in steels which have previously undergone cold-working or heat-treating has in all cases at about 400 deg. cent., a singular point characterized by an evolution of heat.

2 The change of state which takes place at this temperature reaches completion only quite slowly, both in the case of heat-treated steel and in the case of cold-worked steel. Thus, two samples of the same steel, 0.12 per cent carbon, of which one has been tempered from 1000 deg. by immersion in water at 15 deg. and the other cold-worked, then both heated to 640 deg. for a period of 25 min., still show, during the second reheating, the singular point at 400 deg. cent. After a heating for 12 hours at 600 deg. cent. the transformation is completed and a new curve of heating does not show any irregularities.

3 This change of state is irreversible. The curves of cooling of both heat-treated and cold-worked steel have the perfectly regular appearance. This transformation must be accompanied by a sudden change of volume. Since the metal is not malleable at 400 deg. cent., it becomes subject to internal stresses which produce a breakdown of equilibrium. If, then, by external work, such as hammering, these internal stresses are still more intensified, the most favorable conditions are created to cause rupture of material, which is actually quite frequent when cold-worked steel is heated and subjected to mechanical working at about 400 deg. cent.

[*Journal*, June 1918, p. 500]

[Source: F. Clouy, *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, March 11, 1918, pp. 415-416]

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### QUENCHING OILS FOR FORGINGS

Wool grease for quenching forgings has been known for several years and is claimed to have unusual powers of heat circulation and heat absorption. It is also claimed that it does not decompose after repeated use or show indications of further fractional distillation.

Fig. 6 shows the hardening power of distilled wool grease. Tests were made for quenching speed at different temperatures. The test piece was made from

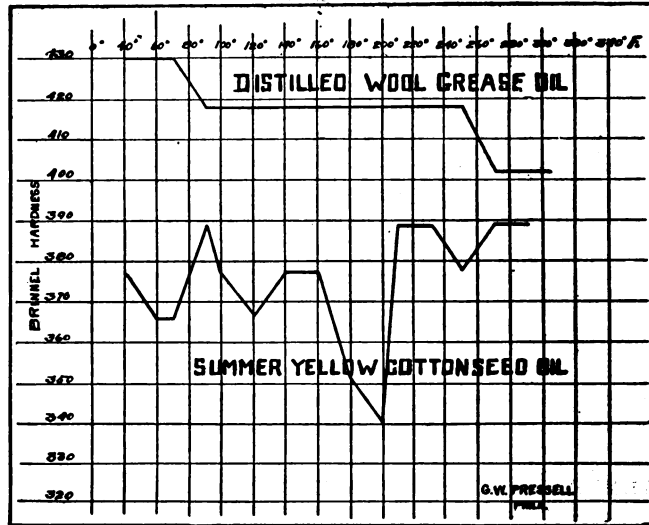


FIG. 6 CURVES SHOWING HARDENING POWER OF DISTILLED WOOL GREASE AND YELLOW COTTONSEED OIL.

low-carbon chrome-vandium steel 17 in. long and  $3\frac{1}{4}$  in. wide. The test piece was heated at 1200 deg. fahr., then quickly immersed to a constant depth in 25 gal. of the quenching fluid, the immersion being such that the quenched mass was equally surrounded on all sides by the same depth of quenching fluid. A stop watch was used to measure the time required to cool the steel from 1200 to 600 deg. fahr.

The following data were obtained with distilled wool-grease oil:

Temperature of quenching bath, deg. fahr.	Seconds	Temperature of quenching bath, deg. fahr.	Seconds
82	97	190	102
97	99	202	102
112	102	215	105
125	104	222	106
138	103	230	104
149	102	238	105
160	101	245	103
170	101	249	102

The average quenching speed was 102 sec. The total variation was 9 sec.

[*Journal*, September 1918, pp. 775-776]

[Source: G. W. Pressell, *American Drop Forger*, July 1918, pp. 273-277]

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## EFFECT OF PRESENCE OF A SMALL AMOUNT OF COPPER IN MEDIUM-CARBON STEEL

Two types of steel were tested: one containing 0.30 per cent carbon, 0.012 per cent phosphorus, and 0.860 per cent copper, and the other 0.365 per cent carbon, 0.053 per cent phosphorus, and 0.030 per cent copper. The accompanying chart in Fig. 7 shows that high-copper steel has decided superiority in tensile strength, yield point and ultimate strength, while the ductility is practically the same. Hardness tests by both methods show high-copper steel to be harder than low-copper, and the Charpy shock tests show high-copper steel also superior to low-copper. The tests confirm those made by Stead, showing that

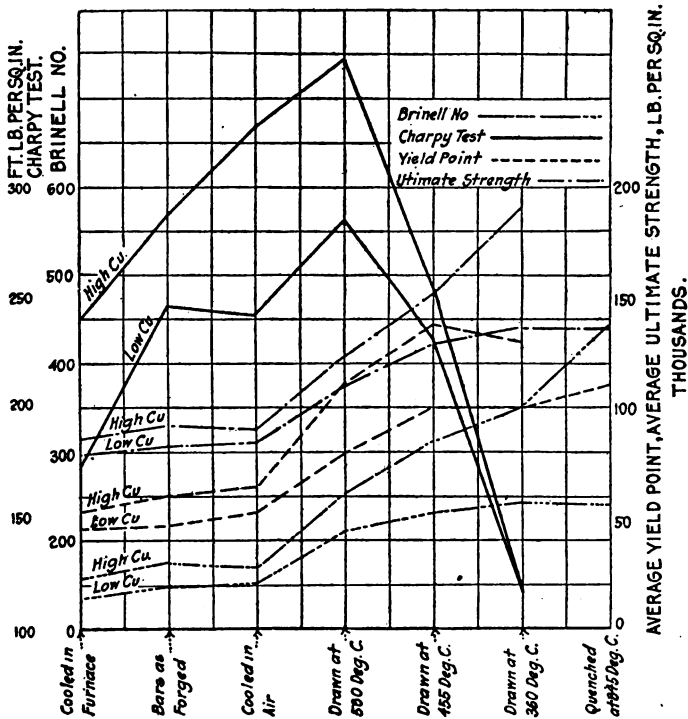


FIG. 7 PHYSICAL PROPERTIES OF COPPER-BEARING MEDIUM-CARBON STEEL

the behavior of copper steel resembles that of nickel steel. The high-copper steel shows finer grain than the low-copper. The quenched and drawn specimens of high-copper steel were found to be slightly more martensitic.

[*Journal*, February 1918, p. 191]

[Source: C. R. Hayward and A. B. Johnston, *Bulletin of the American Institute of Mining Engineers*, January 1918, pp. 159-167]

# ENGINEERING DATA

## ERICHSEN TESTS ON ALUMINUM SHEETS

Tests made with the Erichsen ductility-testing apparatus on annealed 18-gage cold-rolled aluminum sheets reduced in the cold from a 0.25-in. slab to 18 gage. The metal employed was American metal of high purity containing over 99 per cent aluminum with impurities normal. Annealings were made in a laboratory electric furnace of the resistance type under pyrometric control and the temperatures are accurate within 10 deg. cent. Results are shown in Tables 4 and 5.

TABLE 4 EFFECT OF ANNEALING 18-GAGE ALUMINUM SHEETS; TEMPERATURE VARIABLE, AND TIME CONSTANT AT TWO HOURS

Sample	Temperature in deg. cent.	Thickness in millimeters	Indentation in millimeters	Scleroscope hardness	Appearance of domes
1	As rolled	1.08	6.83	14.0	.....
2	100	1.08	6.96	13.5	.....
3	200	1.09	8.39	10.0	.....
4	300	1.07	10.17	4.5	Smooth
5	400	1.07	10.10	4.5	Medium
6	500	1.09	9.73	4.0	Coarse

Note—(a) Time constant at 120 min.; (b) Values given represent the mean of two closely agreeing determinations.

732 Table 4 shows that the metal attained maximum softness by annealing at 300 deg. cent. for two hours. The effects of annealing at the constant temperature of 200 deg. cent. for various times is given in Table 5 and the data therein show that 200 deg. cent. is too low a temperature to employ for annealing 18-gage cold-worked sheets.

TABLE 5 EFFECT OF ANNEALING 18-GAGE ALUMINUM SHEETS; TIME VARIABLE AND TEMPERATURE CONSTANT AT 200 DEG. CENT.

Sample	Annealed, minutes	Thickness in millimeters	Indentation in millimeters	Scleroscope hardness	Appearance of domes
7	5	1.07	6.89	13.8	.....
8	30	1.07	7.97	11.8	.....
9	60	1.08	8.40	9.5	.....
10	90	1.09	8.84	8.0	.....
11	150	1.09	8.87	8.0	.....

Note—(a) Temperature constant at 200 deg. cent.; (b) Values given represent the mean of two closely agreeing determinations.

Other tests show that complete softening below 5 Shore scleroscope number was obtained by annealing for 1 hr. and 20 min. at 300 deg. cent. Still other tests show that complete annealing may be effected by an exposure of 5 min. at 400 deg. cent., indicating that long-time exposures are unnecessary and may often lead to an increase in waste of material.

Figs. 8 and 9 give graphically the data in Tables 4 and 5.

Fig. 10 shows what happens in the case of annealing at 400 deg. cent.

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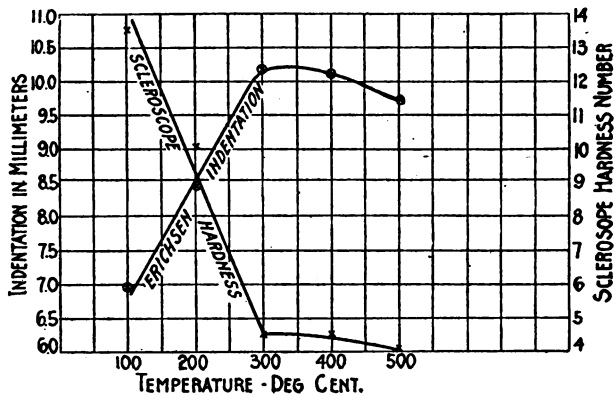


FIG. 8 TEMPERATURE-INDENTATION AND TEMPERATURE-SCLEROSCOPE-HARDNESS CURVES FOR ANNEALINGS ON 18-GAGE ALUMINUM SHEETS. TIME CONSTANT AT 120 MIN.

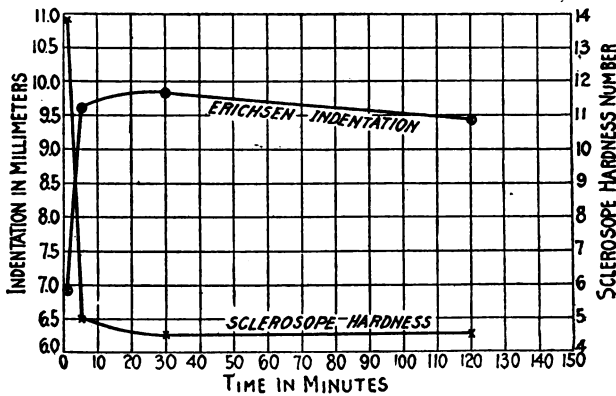


FIG. 9 TIME-INDENTATION AND TIME-SCLEROSCOPE-HARDNESS CURVES FOR ANNEALINGS ON 18-GAGE ALUMINUM SHEETS. TEMPERATURE CONSTANT AT 200 DEG. CENT.

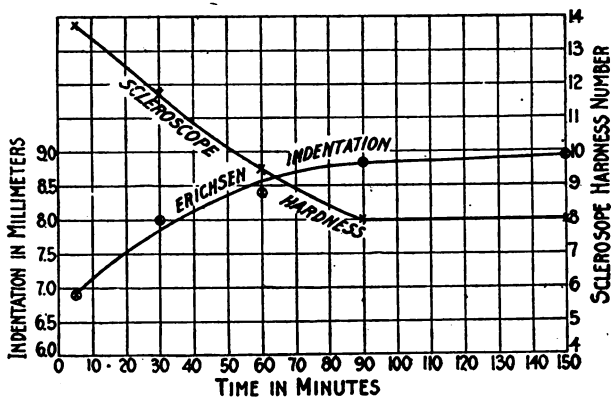


FIG. 10 TIME-INDENTATION AND TIME-SCLEROSCOPE-HARDNESS CURVES FOR ANNEALINGS ON 18-GAGE ALUMINUM SHEETS. TEMPERATURE CONSTANT AT 400 DEG. CENT.

[Journal, June 1918, pp. 506-507]

[Source: R. J. Anderson, *The Iron Age*, April 11, 1918, pp. 950-951]

## TESTING OF ALUMINUM SHEETS

It is claimed that prolonged exposure results in over-annealing, which latter produces a weakened condition of the metal and makes it unfit for drawing. In order to demonstrate roughly how much time is required for annealing, a number of samples of cold-rolled 14-gage aluminum sheets reduced 72 per cent were exposed for two hours at 400 deg. cent. Forty blanks so annealed were drawn in the draw press and all of them successfully withstood the draw. Experiments were then performed with the view of softening the 14-gage cold-rolled sheets by means of relatively short exposures at various temperatures, these annealing experiments being performed in a laboratory electric furnace of the resistance type and the temperatures given are accurate within 10 deg. cent. The time of exposure was 3 min. Fig. 11 gives the temperature-indentation and tempera-

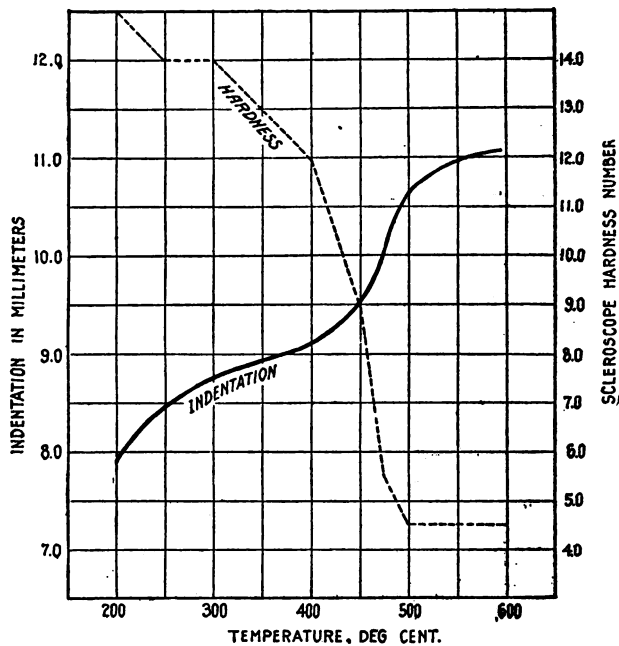


FIG. 11 TEMPERATURE-INDENTATION AND TEMPERATURE-HARDNESS CURVES FOR 14-GAGE ALUMINUM SHEETS EXPOSED FOR 3 MIN.

ture-hardness curves for these tests and shows that the scleroscopic hardness falls off rapidly with increasing temperature and the indentation increases gradually to a maximum attained at the exposure at the highest temperature employed.

The preliminary short-time annealing experiments showed that 14-gage cold-rolled aluminum sheets could be softened at 4-5 Shore scleroscope hardness numbers by 3-min. exposures at temperatures of 500 deg. cent. and above. In



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the next series 80 cold-rolled blanks were annealed at constant temperature and variable time, as shown in the Fig. 12. It was found that softening, so far as

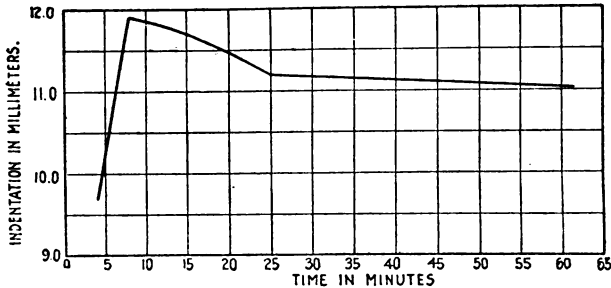


FIG. 12 TIME-INDENTATION CURVE FOR 14-GAGE ALUMINUM SHEETS AT 450 DEG. CENT.

required by practice, can be effected for cold-rolled 14-gage aluminum sheets by an exposure of as little as 8 min. at 450 deg. cent.

See preceding page for account of Erichsen tests made on annealed 18-gage aluminum sheets.

[*Journal*, September 1918, p. 788]

[Source: R. J. Anderson, *The Iron Age*, July 18, 1918, pp. 148-149]

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## HARDENING OF ALUMINUM BRONZE

Thermal treatment improves aluminum bronzes with at least 7 per cent copper. Addition of iron, silicon and other elements varies the mechanical properties of the alloys. The following table shows properties of a 10 per cent aluminum bronze containing some titanium, the percentage of which is not quoted:

	Bronze as Cast	Quenched Bronze	After Thermal Treatment at Different Temperatures
Limit of elasticity.....	9.6	19.8	27.7 to 19.2 kg. per sq. cm.
Tensile strength.....	51.8	73.6	67.7 to 64 kg. per sq. cm.
Elongation.....	19.5	1.0	5.5 to 1.4 per cent
Contraction of area.....	33.7	0.8	9 to 18.5 per cent
Brinell hardness.....	100	262	158 to 140

[*Journal*, January 1918, pp. 104-105]

[Source: *Giesserei Zeitung*; also, *The Journal of Industrial and Engineering Chemistry*, December 1917, p. 1144]

## MOISTURE REABSORPTION OF AIR-DRIED DOUGLAS FIR AND HARD PINE AND THE EFFECT ON THE COMPRESSIVE STRENGTHS

The following results shown from the tests should be considered as comparative and qualitative rather than quantitative. The analysis of the data, the author feels, will justify the following statements:

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In the air-dry condition with approximately equal moisture contents the compressive strength of hard pine is about 25 per cent greater than that of Douglas fir.

When exposed to air saturated with water vapor at 120 deg. fahr., and when immersed in fresh water at 70 deg. fahr., the moisture reabsorption of air-dried fir is greater and more rapid than that of pine.

The temperature effect on strength decrease is of more importance on pine than on fir.

Pine shows a more rapid decrease in strength with the moisture increase than does fir. (The more rapid reabsorption by fir tends to offset this effect when the time element is used as a basis, so that, for a given time of treatment, the pine remains the stronger although the strengths tend to approach each other with more extended treatment.)

For moisture contents above 11 per cent when due to reabsorption from air saturated at 120 deg. fahr., the fir is stronger in compression than the pine. The same relation appears for moisture contents greater than 20 per cent when due to soaking in fresh water at 70 deg. fahr.

The regain of moisture by wood is not confined to kiln-dried wood, but occurs as well in the case of timber which has been thoroughly air-dried. In fact, the reabsorptive power of air-dried timber is believed to be somewhat greater than that of timber which has been properly and thoroughly kiln dried.

[I. H. Cowdrey. *Trans.*, vol. 40, p. 53]

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## FRICITION OF SLIME PULP IN PIPES

Steel pipe used. The slime pulp consists of finely comminuted particles of rock (200 mesh and less) mixed with water in proportions varying from 1 : 1 down to almost pure water. The friction head for slime is about 13.5 per cent less than for water (confirmed by later tests with thicker pulp).

Since the friction head of the ordinary slime pulp (measured in feet of slime) appears to be less than friction head of water (measured in feet of water), and since the pipe for the discharge of slime may have to be used for discharging water, a safe rule is to specify the pump speed, so as to elevate water to the required height, plus the friction in the pipe due to water, and the power of the motor driving the pump to elevate slime to about the same height. In practice this will mean a motor of about 50 per cent greater power than required for water pumping. The piping should be as straight as possible, avoiding sharp elbows and vertical drops of more than 20 feet. Velocity of flow should be not less than  $4\frac{1}{2}$  ft. per sec., and it is good practice to use 6 to 7 ft. per sec.

[*Journal*, January 1918, pp. 116-117]

[Source: E. J. Laschinger, *The Journal of the South African Institution of Engineers*, June 1917, pp. 279-283]

## THE STRENGTH OF SEWER PIPE

Pipe in a ditch is so much more rigid than the ditch filling at each side of the pipe, that even with careful tamping the pipe carries practically all of the vertical

## ENGINEERING DATA

load at the level of the top of the pipe caused by or transmitted through the ditch filling. The width of the ditch at the elevation of the end of the top 90-deg. quadrant is the width factor that affects the load on the pipe.

For loads on pipes in ditches where the trench is hollowed to conform to the bottom quadrant of the circumference of the pipe, the formula is

$$W = Cwb^2$$

where

$W$  = load on pipe in ditch, lb. per lin. ft.

$C$  = coefficient (see Table 1 in original article, p. 57, *Western Engineering*, Feb. 1918; values vary from 0.455 to 4.545).

$w$  = weight of ditch-filling material, lb. per cu. ft.

$b$  = breadth of ditch a little below top of pipe, ft.

Use net inside length of pipe from bottom of hub socket to extremity of the spigot end in computing ordinary supporting strength of pipe per unit of length. For calculating modulus of rupture of sewer pipe from ordinary supporting length, as above, the formulæ adopted for drain tile by the American Society for Testing Materials should be used, as follows:

$$M = 0.20rW/12, \text{ and } F = 6M/t^2$$

where

$M$  = maximum bending moment in the pipe wall of the barrel of the pipe, lb-in. per in. of length.

$r$  = radius of the middle line of the pipe wall of the barrel of the pipe, in.

$W$  = ordinary supporting strength of the pipe, calculated as described in the preceding paragraphs, lb. per lin. ft. of pipe.

$F$  = modulus of rupture of the pipe, lb. per sq. in.

$t$  = average thickness of the pipe wall of the barrel of the pipe in inches at either the top or the bottom, the lesser value being used.

In computing  $M$  for "sand" bearings add  $\frac{1}{8}$  of the weight of the pipe per linear foot to  $W$ , provided such addition exceeds 5 per cent of  $W$ . For "two-point" or "three-point" bearings add  $\frac{1}{4}$  of the weight of the pipe.

[*Journal, April 1918, p. 344*]

[Source: *Bulletin No. 47, Engineering Experiment Station of Iowa State College of Agriculture; Western Engineering, February 1918, pp. 57-59*]

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## THE VALUE OF "g" IN ENGINEERING AND PHYSICAL WORK

Correction data for  $g$  given in a form particularly convenient for actual use. Coast and Geodetic Survey officials, and Prof. E. V. Huntington collaborated in preparing the data.

The standard value  $g_0$  is 980.665 cm./sec<sup>2</sup>. or 32.1740 ft./sec<sup>2</sup>. This has been arbitrarily selected by international agreement and is nearly the average value at sea level, 45 deg. N. latitude.

In all cases where a force of a pound is used it is to be understood as being the "standard pound force," which is a force giving the "standard weight" of one pound an acceleration of the standard value  $g_0$ .

## ENGINEERING DATA

In measuring forces by instruments which depend upon the attraction of gravity, the readings must be reduced to standard pounds by use of the correction factors given. Correction for latitude has a maximum value of about fourteen hundredths of one per cent (in the southernmost part of the United States). Correction for elevation is about one one-hundredth of one per cent per 1000 ft. elevation. There is a further correction for "anomaly," which is about one one-hundredth of one per cent on a few mountains and less than half of this value everywhere else, so that it is negligible for engineering work.

Table 6 gives the principal correction factor to within  $1/100$  of one per cent, which is accurate enough for engineering purposes.

Multiply the measurements of a force in a weight scales by the correction factor in the body of the table and add to the reading.

TABLE 6 CORRECTION FACTOR FOR  $g$

North latitude deg.	Elevation in feet, $H_f$							
	0	2000	4000	6000	8000	10000	12000	14000
25	-.0017	-.0019	-.0021	-.0023	-.0025	-.0027	-.0029	-.0031
30	-.0014	-.0016	-.0018	-.0019	-.0021	-.0023	-.0025	-.0027
35	-.0010	-.0011	-.0013	-.0015	-.0017	-.0019	-.0021	-.0023
40	-.0005	-.0007	-.0009	-.0011	-.0013	-.0015	-.0017	-.0019
45	-.0001	-.0002	-.0004	-.0006	-.0008	-.0010	-.0012	-.0014
50	+.0004	+.0002	.0000	-.0002	-.0004	-.0006	-.0007	-.0009

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More accurate correction data were obtained, not shown here, these being required only for refined physical work.

Taking  $W_0$  as the weight of a body at any point found by comparing it with the "standard pound weight" by means of a weight scales,  $F$  as force measured in "standard pounds" as already defined, and  $a$  as acceleration in ft./sec<sup>2</sup>, the well-known fundamental equation then becomes

$$F = W_0 a / g_0$$

In all formulæ in which  $g$  occurs in connection with the standard units mentioned, the value is understood as being  $g_0$ , regardless of place.

The now usually accepted definition makes the horsepower exactly equal to 746 watts. This gives 550.22 "standard foot-pounds."

[*Journal*, June 1918, pp. 507-508]

[Source: S. A. Moss, *General Electric Review*, May 1918]

## STANDARD SYMBOLS IN MECHANICS

A great deal of work has been done by the Society for the Promotion of Engineering Education in attempting to secure uniformity of practice in the use of uniform symbols and abbreviations used in technical literature. Prof. John T. Faig, Mem. Am. Soc. M. E., has taken an active interest in this useful work and has furnished for publication the following symbols for formulæ in mechanics which were approved by the S. P. E. E. on June 28, 1918:

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Concept	Symbol
Acceleration, angular.....	$\alpha$ (Alpha)
Acceleration, due to gravity.....	$g$
Acceleration, linear.....	$a$
Area.....	$A$
Breadth.....	$b$
Center of rotation.....	$O$
Coefficient of friction.....	$f$
Coefficients and constants.....	$C, K$
Deflection of beam.....	$y$
Depth.....	$d$
Diameter.....	$D$
Distance passed over.....	$s$
Distance of extreme fiber from neutral axis.....	$c$
Eccentricity of application of load.....	$e$
Efficiency (hydraulic mechanical, volumetric).....	$e_h, e_m, e_v$
Force.....	$F$
Force, moment of.....	$M$
Friction, coefficient of.....	$f$
Head.....	$H$
Height.....	$h$
Horsepower.....	$hp$
Hydraulic radius.....	$R_h$
Inertia, polar moment of.....	$J$
Inertia, rectangular moment of.....	$I$
Length.....	$L$
Load, eccentricity of application of.....	$e$
Mass.....	$m$
Modulus of section.....	$Z$
Modulus of elasticity, Young's.....	$E$
Moment of force.....	$M$
Moment of inertia, polar.....	$J$
Moment of inertia, rectangular.....	$I$
Quantity of liquid flowing.....	$Q$
Radius.....	$r$
Radius of gyration.....	$k$
Reactions.....	$R$
Revolutions per unit of time.....	$N$
Stress, unit.....	$S$
Time.....	$t$
Torque.....	$T$
Velocity, angular.....	$\omega$ (Omega)
Velocity, linear.....	$v$
Volume.....	$V$
Weight.....	$W$
Young's modulus of elasticity.....	$E$

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[*Journal, October 1918, p. 856*]

[Source: J. T. Faig, *Bulletin of the Society for the Promotion of Engineering Education*]

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### ELASTIC INDENTATION OF STEEL BALLS UNDER PRESSURE

While the maximum pressure used in the authors' experiments was but 20 lb., exerted on steel balls  $\frac{3}{4}$  and 1 in. in diameter placed between glass plates, they nevertheless believe that the following formula will apply to much higher pressures and for steel balls between flat steel surfaces:

$$2dG = 0.0000166 P^{2/3} / G^{1/3}$$

where

$2dG$  = indentation from both sides of the ball, expressed in inches.

$G$  = radius of curvature of the steel ball in inches.

$P$  = total pressure acting between the surfaces in pounds.

Results of tests indicate that the indentation is not linear with the pressure as is commonly supposed, but is proportional to the two-thirds power of the pressure, which is the exponent used in the above equation. This fact is of importance in connection with the design of ball bearings, as it shows the effects produced on the distribution of the load by slight variations in the size of the balls in a bearing.

The original article includes six charts which can be used in scanning off the desired value when two quantities in the above equation are known.

[C. A. Briggs, W. C. Chapin and H. C. Heil. *Trans.*, vol. 40, p. 139]

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### DESIGN OF SPRINGS FOR OSCILLATING MASSES

In certain applications springs are fitted to oscillating masses to relieve a crank drive of acceleration forces or, in general, to permit a certain latitude of motion in one part while relieving others of shock. One of the primary functions of springs is to relieve the driving members (e. g., connecting rod, eccentric and crankshaft bearings, etc.) of "free forces" due to reversal of oscillating masses, which free forces cannot be balanced within the machine itself. The spring should be capable of continuing the oscillating motion; in other words, the drive has only to overcome the air resistance and friction of the moving parts once the oscillation is started. In order to secure the same frequency, the force exerted by the spring at maximum deflection must equal the centrifugal force of the oscillating mass at its dead point. The centrifugal force exerted at the distance  $r$  cm. from the center by  $G$  kg. at  $n$  revolutions per minute is:

$$P = G(r/100) (n/30)^2$$

The spring is designed so that it is deflected  $r$  cm. by the force  $P$ , and is not then overstressed. The present comparison between various types of springs is based on the following assumptions: Spring steel with  $E = 2,200,000$  kg./cm<sup>2</sup>; bending stress at deflection  $r$  cm. = 3000 kg./cm<sup>2</sup>. unhardened and 4000 to 5000 kg./cm<sup>2</sup>. hardened; half these values for machine steel. In a numerical example for each case  $G = 50$  kg.;  $r = 2$  cm.;  $n = 300$  r.p.m.; then the centrifugal force and spring force  $P = 100$  kg. The cases considered are: Parallel plate spring with one end fixed and with both ends fixed; triangular plate springs and the practical form of the latter, the trapezium plate; rectangular and round rod springs (including the case of a bundle of rods and that of rods held at both ends); cubic paraboloid (round rod to uniform resistance); and tapered round-rod springs. Sections of uniform resistance

or approximations thereto are most economical of material. Rod springs of standard profile may be conveniently applied to a variety of load conditions and they are flexible in all directions. Parallel round-rod springs require four times as much material as triangular plate springs and  $\frac{4}{3}$  times as much material as parallel plate springs and rectangular rods owing to the fact that maximum stress exists only in the clamped section and along the outer fiber thereof. If the form of the rod be a cubic paraboloid, the material required is only  $\frac{1}{3}$  that of a cylindrical round rod and  $\frac{4}{3}$  that of a triangular plate spring. The section in which maximum stress occurs in a tapered round rod depends on the degree of taper. Up to the critical ratio of taper,  $D/d = 1.5$ , the stress at the clamp determines the design; with more pronounced taper, the danger section moves toward the point of the spring. The relative economy in material of various patterns of spring is shown by the following formulæ for their volume:

	Volume		Volume
Parallel plate spring.....	2.2 <i>Pr</i>	Plain taper round rod:	
Triangular plate spring.....	0.73 <i>Pr</i>	With $D/d = 1.0$ .....	2.935 <i>Pr</i>
Trapezium plate spring:		$D/d = 1.25$ .....	1.91 <i>Pr</i>
limits.....	0.73 to 2.2 <i>Pr</i>	$D/d = 1.5$ .....	1.377 <i>Pr</i>
Trapezium plate spring:		$D/d = 1.84$ (max.	
$b/B = 1/5$ .....	0.97 <i>Pr</i>	economy)....	1.18 <i>Pr</i>
Rectangular-rod spring.....	2.2 <i>Pr</i>	$D/d = 2.0$ .....	1.20 <i>Pr</i>
Parallel round-rod spring.....	2.935 <i>Pr</i>	$D/d = 2.5$ .....	1.45 <i>Pr</i>
Cubic paraboloid.....	0.978 <i>Pr</i>	$D/d = 3.0$ .....	1.88 <i>Pr</i>

The thickness of a plate spring is limited by the deflection, and its breadth by the force and frequency. In a bundle of spring rods either the number or the length may be chosen freely.

[*Journal, June 1918, p. 508*]

[Source: G. Lindner, *Science Abstracts*, Section B, Electrical Engineering, No. 242, pp. 64-65]

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## TYPE OF THREAD AS AFFECTING PIPE JOINTS

Investigation to develop a pipe joint having greater resistance to impact and vibration than the present type. One-inch signal pipe was used, while some vibratory tests were made on  $1\frac{1}{4}$ -in. extra heavy pipe and a number of internal pressure tests on  $2\frac{1}{2}$ -in. steam. pipe. Table 7 gives a summary of tensile-strength, drop and bending tests. Joints tested were: (1) regular Briggs thread on pipes and regular Briggs-thread steam coupling; (2) round-bottom, sharp-top thread on pipe and regular Briggs-thread steam coupling; (3) round-bottom, round-top 55-deg. thread on pipe and regular Briggs-thread coupling; (4) round-bottom, round-top 60-deg. thread on pipe and regular Briggs-thread coupling.

Air-pressure and water-pressure tests indicate that equally good joints can be made with mixed threads as with the Briggs thread alone, and, on the whole, the tests indicate that the different types of thread may be used together without difficulty on the smaller-size pipe and with slight difficulty on the larger-size pipe, but when the thread galls there is some tendency to produce a leaky joint.

Table 7 gives results of tests, from which these conclusions are drawn: (1) Round thread is superior to Briggs thread in tensile strength of joint, in impact resistance, in amount that threaded pipe may be bent, and in resistance of joint

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**TABLE 7 TENSILE TESTS, DROP TEST AND BENDING TESTS ON THREADED PIPE**  
Comparison of Unannealed and Annealed Black Steel Pipe with Round and Sharp Threads and Wrought Iron Pipe with Sharp Threads. Each Series of Steel-Pipe Tests were Cut from the Same 1-In. Standard-Weight Pipe

Material <sup>1</sup>	Kind of Thread	Average tensile strength of joints, lb.	Drop test with 26-lb. weight Average number of blows at height of		Results: pieces broken in drop tests	Bending Tests	
			2 ft. 6 in	4 ft.		Angle of bend, deg., average	Pieces broken
Steel, as finished.....	Briggs	19,250	6.17	0.33	6	39.7	6
Steel, annealed.....	Briggs	18,850	6.17	0.67	6	80.0	5
Steel, as finished.....	Round	21,325	7.5	6.7	1	103.6	0
Steel, annealed.....	Round	21,850	7.5	5	2	109.5	0
Wrought iron, as finished	Briggs	15,730	3.8	0	6	19.0	6

<sup>1</sup> Number of tests in each case = 6

to vibration; (2) annealed joints are more resistant to shock, bending and vibration than the unannealed, and equally strong in tensile strength; (3) steel joints are superior to wrought-iron. [Table shows only one condition of test with wrought-iron pipe as basis for conclusion (3).—EDITOR.]

[*Journal, February 1918, pp. 199-200*]

[Source: National Tube Co., *The American Drop Forger*, December 12, 1917, pp. 408-409]

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## LOSSES OF HEAT THROUGH ENGINEERING AND BUILDING MATERIALS

In tests made at Pennsylvania State College it has been shown that in the case of glass, as well as other poor insulators, practically all high resistance, is to be found in the so-called surface resistance. In spite of their entirely opposite insulating properties corkboard and glass exhibited a rather remarkable agreement in their value of  $k_1$  (radiation and convection effect of surface on warm side or surface transmission in B.t.u. per 24 hours per sq. ft. per degree difference of temperature),  $k_2$  (surface transmission on cool side), and  $K$  (total surface transmission for both sides), the values at 70 deg. difference of temperature being, respectively, 59, 43 and 25 for corkboard and 90, 46 and 30 for glass. The higher values for glass are probably due to its smooth surface and transparency to radiation from within the test box.

Tests were carried out on air spaces formed by building paper. The curves in the lower half of Fig. 13 show that there is an appreciable increase in the value of  $u$ , which is transmission in B.t.u. per 24 hours per sq. ft. per deg. fahr. with increase of temperature difference, as was also found by the Bureau of Standards. The curves in the upper part of the figure were obtained by plotting the values of the lower half as percentages of the fall of  $u$  for one layer of paper at a particular temperature difference. These curves show that for the ordinary differences of temperature found in heating and refrigerating and for  $\frac{1}{2}$ -in. dead air spaces, the total transmission varies inversely as the number of layers of paper; in fact, the transmission falls off more rapidly, the statement implies, and, therefore the rule will give results on the safe side for insulation problems. For



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temperature differences higher than, say, 100 deg. Fahr., the greatly increased effect of radiation would render this simple rule useless.

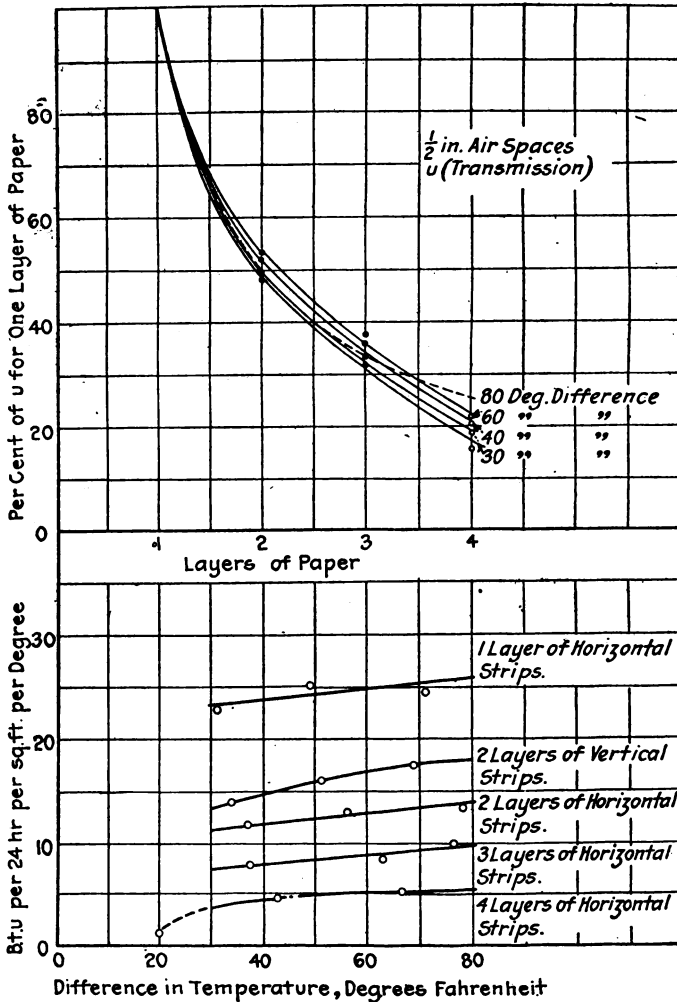


FIG. 13 TOTAL TRANSMISSIONS FOR 1/4-IN. AIR SPACES

The total surface transmission (both sides) for corkboard, glass and building paper, in the usual ranges of temperature for conditions involving slight air movements, is not far from 25 to 30 B.t.u. per 24 hours per sq. ft. per deg. Fahr., and in the case of poor insulators rises to about 50 for a moderate velocity on the warm side and a higher velocity (1000 ft. per min.) on the cool side.

[Journal, July 1918, pp. 596-597]

[Source: R. B. Fehr, Mem. Am. Soc. M. E., The Pennsylvania State College Bulletin, February 15, 1918]

# ENGINEERING DATA

## MEANS FOR REDUCING HEAT LOSSES FROM PIPES AND BOILERS

Table 8 shows the proper thickness of 85 per cent magnesia for maximum net savings when applied to various-sized pipes, and under different temperatures.

TABLE 8 THICKNESS OF 85 PER CENT MAGNESIA FOR MAXIMUM NET SAVING  
Thickness in Inches. S = Standard Thickness

Coal at \$2 per Ton						Coal at \$4 per Ton					
Size Pipe, Inches	Hot Water, 175° F.	Steam, 5 Lb.	Steam, 100-200 Lb.	200 Lb. 150° F. Super-heat	300° F. Super-heat	Size Pipe, Inches	Hot Water, 175° F.	Steam, 5 Lb.	Steam, 100-200 Lb.	200 Lb. 150° F. Super-heat	300° F. Super-heat
¾	S	S	S	S	S	¾	S	S	S	1½	2
1½	S	S	S	S	2	1½	S	S	1½	2	2
3	S	S	S	1½	2	3	S	S	2	2	3
6	S	S	1½	2	2	6	S	S	2	3	3
12	S	S	2	2	3	12	S	S	3	3	4
24	S	S	2	3	3	24	S	S	3	4	4
Flat	¾	1½	2	3	3½	Flat	2	2	3	4	4½
Coal at \$6 per Ton						Coal at \$8 per Ton					
Size Pipe, Inches	Hot Water, 175° F.	Steam, 5 Lb.	Steam, 100-200 Lb.	200 Lb. 150° F. Super-heat	300° F. Super-heat	Size Pipe, Inches	Hot Water, 175° F.	Steam, 5 Lb.	Steam, 100-200 Lb.	200 Lb. 150° F. Super-heat	300° F. Super-heat
¾	S	S	1½	2	2	¾	S	1½	1½	2	3
1½	S	S	1½	2	3	1½	S	1½	2	3	3
3	S	1½	2	3	3	3	1½	2	3	3	4
6	S	2	2	3	4	6	1½	2	3	4	4
12	1½	2	3	4	4	12	2	3	3	4	5
24	2	3	3	4	5	24	2	3	4	5	6
Flat	2½	3	4	6	5½	Flat	2½	3½	4½	5½	6½

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Table 9 expresses in money value per hundred lineal ft. of pipe the saving per month, with pipe covered with "standard" thick coverings and with coal at \$5 per ton.

TABLE 9 MONTHLY COAL SAVING, IN DOLLARS AND CENTS, BY THE USE OF 85 PER CENT MAGNESIA PIPE COVERING, STANDARD THICKNESS, PER 100 LINEAL FT. OF STEAM PIPES

Size of Pipe, Inches	5 Lb. Steam Pressure	10 Lb. Steam Pressure	50 Lb. Steam Pressure	100 Lb. Steam Pressure	150 Lb. Steam Pressure	200 Lb. Steam Pressure	200 Lb. Steam Pressure, 100° Superheat
¾	1.44	1.58	2.20	3.28	3.66	4.11	6.80
1½	1.72	1.89	2.87	3.70	4.26	4.89	8.03
3	2.11	2.30	3.56	4.80	5.35	6.04	10.00
1½	2.52	2.74	4.22	5.52	6.50	7.25	12.20
3	2.86	3.10	4.73	6.14	7.29	8.17	13.70
2	3.53	3.74	5.86	7.63	8.93	10.11	16.80
2½	4.25	4.39	6.95	9.07	10.55	11.90	19.90
3	5.00	5.33	8.30	10.90	12.60	14.30	23.82
3½	5.72	6.22	9.60	12.40	14.40	16.32	27.23
4	6.50	7.06	10.60	14.05	16.40	18.40	30.85
4½	7.30	7.69	11.80	15.35	17.92	20.25	34.00
5	7.97	8.64	13.16	17.20	20.00	22.72	38.00
6	9.36	10.15	15.60	20.38	23.82	26.88	44.90
7	10.90	11.70	18.38	23.68	27.60	30.80	52.00
8	12.26	13.22	20.40	26.60	31.20	34.90	58.55
9	13.80	14.70	22.70	29.00	34.52	38.61	64.80
10	15.08	16.33	25.00	32.70	38.40	43.08	72.40
Flat surface, area 100 sq. ft., 1¼ in. thick.....	5.26	5.67	8.80	11.50	13.48	15.12	25.44

These savings are based on pipes carrying steam for 24 hours per day and 30 days per month. Coal is figured at \$5 per ton (2000 lb.) delivered. Combined efficiency of furnace and boiler 70 per cent. Room temperature 75 deg. fahr.

[J. D. Bagley. Trans., vol. 40, pp. 683-685]

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### HEAT LOSSES FROM UNINSULATED HOT SURFACES

Table 10 shows the loss of heat from uninsulated hot surfaces under different conditions, and brings out the great importance of covering pipe and boiler surfaces in a power plant. For example, even at atmospheric pressure it requires

TABLE 10 HEAT LOSSES FROM UNINSULATED HOT SURFACES

Ordinary steam temperatures; temperature of surrounding air, 70 deg. fahr.					
Steam pressure (gage), lb.	Steam temperature, deg. fahr.	Difference between temp. of steam and surrounding air, deg. fahr.	Loss per sq. ft. per hr., B.t.u.	Waste of coal in lb. per sq. ft. per year	No. of sq. ft. of surface that wastes ton of coal in 1 yr.
0	212	142	334	293	6.82
10	240	170	425	372	5.38
25	267	197	522.5	458	4.37
50	298	228	644	564	3.55
75	320	250	737.5	646	3.10
100	338	268	820	718	2.79
150	366	296	960	840	2.38
200	388	318	1079	945	2.12
250	406	336	1184	1036	1.93

Temperature lower than 212 deg. fahr.

Surface temperature, deg. fahr.	Dif. betw. temp. of surface and surrounding air, deg. fahr.	Heat loss per sq. ft. per hr., B.t.u.	Waste of coal in lb. per sq. ft. per year	No. of sq. ft. of surface that wastes 1 ton of coal in 1 yr.
100	30	56.6	49.6	40.3
120	50	97.5	85.4	23.4
140	70	142	124.3	16.1
160	90	190	166.3	12.03
180	110	242	212	9.44
200	130	298.5	261.5	7.65

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Above figures involving waste of coal are based on the following: 10,000 B.t.u. available per lb. of coal, which is equivalent to a boiler efficiency of 70 per cent, using coal with an assumed heating value of about 14,000 B.t.u. per lb.

These figures are very conservative, as both the boiler efficiency and the heat value of the coal are high—a lower boiler efficiency or inferior grade of coal would cause even a greater waste in pounds of fuel.

only about 7 sq. ft. of surface, and at 100 lb. less than 3 sq. ft. of surface, to waste a ton of coal in a year. Therefore, even one pair of 10-in. flanges without insulation represents a loss of a ton of coal per year.

[L. B. McMillan. *Trans.*, vol. 40, pp. 688-689]

### HEAT TRANSFER FROM AIR PIPES

Opinions vary regarding rate of heat transfer from air to pipes and references show variations in  $k$  (coefficient of heat transfer from air to pipe in B.t.u. per hr. per sq. ft. of air contact surface, per deg. fahr. mean temperature difference between air and surface) from 13 to 1 B.t.u. In tests made on standard four-row indirect or coil pipe heaters composed of 1-in. pipes placed on 2  $\frac{5}{8}$ -in. centers, air flowing transversely through the heater, the figures for  $k$  obtained agree with the following formula:

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$$k = \frac{1}{0.0447 + \frac{50.66}{v}} \text{ B.t.u.}$$

where  $v$  = velocity of air through the clear area of the heater in feet per min. Up to 1200 ft. per min.  $k$  can be expressed by the approximate formula

$$k = k_0 \left( \frac{v}{v_0} \right)^{3/4}$$

where  $v_0$  is the velocity corresponding to  $k_0$ , which proves that up to 1200 ft.;  $k$  varies approximately as the two-thirds power of the velocity, instead of as the square root of the velocity, as has frequently been stated by other investigators.

[*Journal*, January 1918, pp. 115-116]

[Source: C. H. Herter, *A. S. R. E. Journal*, November 1917, pp. 308-332]

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## FUEL CONSERVATION

The standard recommendations of the United States Fuel Administration are substantially as follows:

- a Fuel.* That means be provided for measuring and recording fuel used each shift or day.
- b Water.* That boiler feedwater be heated by exhaust steam or waste heat, and measured.
- c Air Supply.* That a correct amount of air be supplied to the fuel, and that proper means be provided for measuring and regulating the draft.
- d Clean Heating Surfaces.* That boiler heating surfaces be kept clean inside and out.
- e Boiler and Furnace Settings.* That the furnace and setting be kept in good repair and free from air leakage.
- f Insulation.* That exposed steam surfaces wasting heat by radiation be covered with suitable insulating material.
- g Engine-Room and Heating System.* That wherever possible exhaust steam be utilized to the exclusion of direct steam from boilers. (The plant should be designed and operated to produce no more exhaust than can be efficiently utilized in heating and process work.)
- h Supervision.* (1) That a competent employee or committee be detailed to supervise the work of fuel conservation in the boiler and engine plants; and (2) that a competent committee be appointed in charge of the work of the fuel conservation in the buildings and shops outside of the power plants.

[*David Moffat Myers. Trans., vol. 40, p. 225-230*]

## ENGINEERING DATA

### SAVING COAL BY MIXING

Experiments by Lehigh Valley R. R. A saving of about one-third of the coal consumption is claimed for the new plan.

The plan provides for the crushing of bituminous coal and its mixture with anthracite silt, using two parts of the soft coal to one of the silt. Silt or slush is a dust which has passed through a mesh with openings less than  $\frac{3}{32}$  in. in diameter. It has always been considered as a useless waste, and all over the anthracite fields there are lying great banks of this silt.

[*Journal*, June 1918, p. 510]

[Source: *Railway and Locomotive Engineering*, April 1918, p. 117]

### LIMITING COAL IMPURITIES IN PENNSYLVANIA

It is the observation of the Fuel Administration that steam sizes of anthracite containing 40 per cent of impurities are so inefficient in generating steam that the cost of such fuel is commercially prohibitory. Steam sizes of anthracite containing not more than 20 per cent aggregate impurities enable firemen to maintain maximum steam under the most difficult conditions. When the amount of impurities exceeds 20 per cent, there is at once a noticeably increased amount of fuel required to maintain normal steam pressure. In addition to this, there is an increase of 10 per cent in the cost of fuel when the percentage of impurities is increased from 20 to 25 per cent, and a further increased cost in the removal of ashes. All steam coal containing more than 20 per cent of impurities is condemned when it comes under the observation of the Fuel Administration.

The effect of increase in impurities in domestic sizes of anthracite is much more marked than in steam sizes. The domestic sizes include pea, nut, stove, egg and broken coal. Excellent results are obtained with pea coal containing 8 to 10 per cent of slate and the same amount of bone; that is, a total of 16 lb. of impurities in 100 lb. of coal. Pea coal containing 20 per cent of slate is worthless for low-pressure boilers.

Chestnut gives best results when impurities do not exceed 5 per cent of slate and an equal percentage of bone (bone contains 50 per cent of carbon). Any increase above this figure is marked by inferior service. All nut coal containing 7 per cent of slate is condemned by the Fuel Administration.

Stove coal containing 5 per cent of slate and 6 per cent of bone gives maximum service. Egg coal should not be used when the amount of slate is more than 4 per cent and of bone, more than 5 per cent. Broken anthracite must be virtually free from slate or bone, the inspection schedule allowing only 1 per cent of slate and 2 per cent of bone.

In general, the larger the size of anthracite the lower must be the percentage of impurities to obtain maximum service.

[*E. L. Cole. Trans.*, vol. 40, pp. 232-234]

### FUEL OIL VERSUS COAL FOR MARINE USE

Careful computation shows that three oil-burning ships of a given tonnage of, say, 6000 tons each, will yield the same efficiency as four ships of a like tonnage burning coal, or, three hundred oil-burning ships will carry the same cargo as four hundred coal-burning ships of the same size.

[*A. C. Bedford. Trans.*, vol. 40, p. 237]

## ENGINEERING DATA

### FIRING BOILERS WITH ANTHRACITE WASTES

Table 11 represents an attempt to present in an easily understandable form the practical operating conditions of an industrial power plant with highly vary-

TABLE 11 OPERATING RESULTS OF BOILER FIRED WITH ANTHRACITE BUCKWHEATS

	No. 1 Buck- wheat	No. 2 Buck- wheat	No. 3 Buck- wheat	No. 4 Buck- wheat	Un- cleaned Silt
Average hp. of test (24 hours).....	1500	1395	1200	1010	495
Maximum hp. of test.....	1750	1600	1400	1100	650
Average per cent rating.....	200	186	160	134	66
B.t.u. per lb. of dry coal.....	12250	12000	11500	11000	10000
Combined efficiency of boiler, furnace and grate, per cent.....	74	70	65	61	45
Equivalent evaporation from and at 212 deg. per lb. of dry coal, lb.....	9.35	8.77	7.7	6.9	4.6
Dry coal consumed per hp. per hr., lb.....	3.69	3.93	4.48	5.00	7.5
Dry coal per sq. ft. grate surface per hr., lb.....	25	25	25	25	25
Boiler hp. per sq. ft. grate surface.....	6.8	6.36	5.5	4.9	3.3
Grate travel in ft. per hr.....	16.6	16.5	16.2	15.2	11.1
Cost per hp. per hour in cents.....	0.67	0.58	0.43	0.27	0.21

<sup>1</sup> These figures correspond to prices at the mines and have to be adjusted to meet the various freight rates.

ing loads. (750-hp. Maxim boiler with Coxe traveling grate; steam pressure, 125 lb.)

[W. P. Frey. *Trans.*, vol. 40, pp. 309-310]

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### TESTS ON WOOD AND COAL BURNING IN CANADA

Tests were conducted at the Prince Albert Power Plant, Alberta, to determine the relative values of various fuels available locally. These tests were carried out on a hand-fired 72-in. return tubular boiler 18 ft long, normal rating 150 hp. The grates used for coal were one-half herringbone pattern, having a total grate area

TABLE 12 RESULTS OF TESTS WITH WOOD AND COAL

	Bitu- minous Slack	Lignite 50 Per cent Nut 50 Per cent Slack	Jack Pine Cord- wood	Poplar Cord- wood	Spruce Edgings
Duration of test, hr.....	6	6	6	6	6
Gage pressure, lb.....	125	125	125	125	125
Average temperature feedwater, deg. fahr.....	177	179	180	180	178
Average temperature flue gases, deg. fahr.....	490	495	500	485	490
Thickness of fire, in.....	9	4	24	24	24
Draft, in.....	0.12 to 0.19	0.04 to 0.27	0.01 to 0.02	....	0.00 to 0.01
Total water evaporation, lb.....	24,200	22,800	23,600	24,000	24,400
Total fuel fired, lb.....	2,600	4,100	5,565	6,830	8,022
Total fuel fired, cords of 128 cu. ft.....	....	....	2.1	2.75	3.6
Total weight ash and clinker, lb.....	314	374	37	57	108
Per cent ash and clinker.....	12	9	0.65	0.85	1.35
Water evap. per lb. of fuel as fired, lb.....	9.3	5.6	4.3	3.5	3.0
Equivalent evaporation from and at 212 deg. fahr. per lb. of fuel.....	10.0	6.0	4.6	3.8	3.3
Equivalent evaporation from and at 212 deg. fahr. per cord of 128 cu. ft.....	....	....	12,100	9,400	7,300

## ENGINEERING DATA

of 36 sq. ft., with air spaces forming approximately 45 per cent of the total area. In the tests with wood the same herringbone grates were used as for coal, but the ends next to the bridge wall for a distance of 18 in. were covered with sheet iron protected by a layer of ashes.

A poker was used occasionally to consolidate the fuel, and the furnace was kept as full as possible. The quantity of ash with wood was very low, and the grates did not require any cleaning at all. It is stated that the firemen experienced in handling cordwood claimed it much easier work than firing coal.

Table 12 shows the results of the tests.

[*Journal*, December 1918, p. 1045]

[Source: *Power*, October 29, 1918, pp. 624-625]

## STORAGE AND WEATHERING OF COAL

Broadly speaking, the larger sizes of coal, from about No. 3 nut on up through the various sizes of nut, egg and lump, store without giving any trouble. Anthracite and semi-bituminous coal store well in any size. Black lignite or sub-bituminous coal from the West is hardly suitable for storage. The finer sizes of coal, which are used principally for power purposes, are difficult to store; these are generally high in moisture and iron pyrites, and also, because of their small sizes, expose a great number of small surfaces to the air; these several factors tend to initiate oxidation and to speed it along when once started. Eastern coals are purer and lower in moisture and pyrite than Western coals.

Heat from external sources is required to initiate oxidation. Steam pipes near the coal piles, heat from boilers (especially in cases of bunkers on vessels), impact of coal falling when unloaded, and pressure due to high piles, constitute positive dangers. Absorption of heat from the sun will raise the temperature of coal surprisingly, especially when coal is shipped in steel cars exposed to direct rays of the sun.

[*Journal*, April 1918, p. 345]

[Source: W. D. Stuckenberg and J. F. Kohout, *Power*, February 12, 1918, pp. 234-235]

## VALUE OF WOOD AS FUEL

The United States Fuel Administration states:

"One cord of hardwood is equal to a ton of coal, according to experts of the Fuel Administration.

"The Department of Agriculture and the Fuel Administration have statistics showing that there is a vast quantity of dead wood in many sections of the country, and that the supply in many communities is sufficient for domestic purposes."

[*Journal*, January 1918, pp. 99-100]

[Source: *Official Bulletin*, U. S. Fuel Administration, November 30, 1917, p. 5]

## RELATION BETWEEN ASH CONTENT OF COAL AND EVAPORATION

From a large number of observations with coals contaminated with non-combustible impurities the following may be stated:

1 The steaming capacity of coal drops along a parabolic curve; i. e., with the increase of ash content the evaporation drops more rapidly in the beginning and more slowly when ash percentage is getting high. Fig. 14 shows graphically this condition.

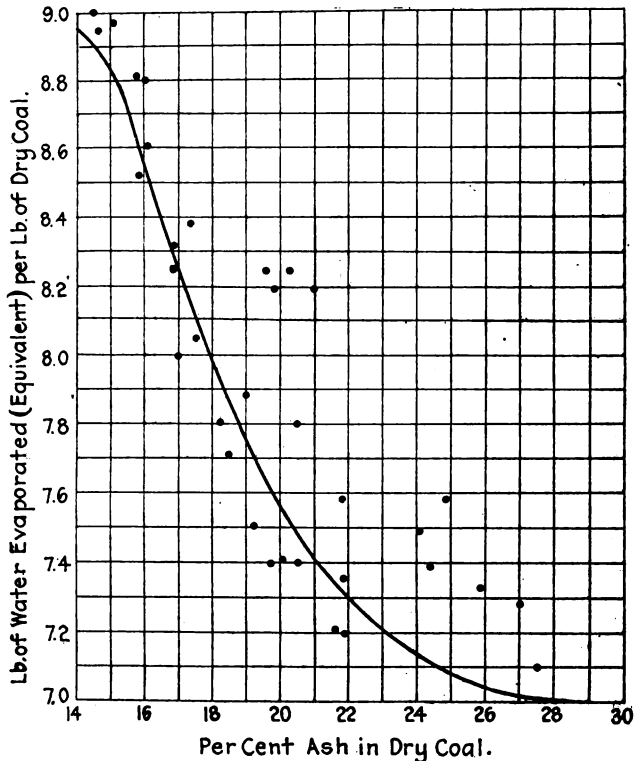


FIG. 14 RELATION BETWEEN ASH CONTENT AND EVAPORATION

2 Judged by the rate of firing (lb. per hr.), excess of air is inevitable with coals high in ash. Additional losses are incurred by more frequent cleaning of fires.

[W. N. Polakov. *Trans.*, vol. 40, pp. 258-259]

Plant records show that coal used from November 1, 1916, to March 1, 1917, evaporated 7.62 lb. water per lb. coal and contained 10 per cent ash. From November 1, 1917, to March 1, 1918, our coal contained 17 per cent ash and evaporated 6.69 lb. water per lb. coal. An increase of 7 per cent in ash content resulted in a loss in evaporation of 12.2 per cent.

[C. E. Van Bergen. *Trans.*, vol. 40, p. 268]



## GRAPHIC METHOD OF DETERMINING SIZE OF SAFETY VALVES

The method given here is based on the rules set forth in the A. S. M. E. Boiler Code, with a modification in the maximum allowable lifts, which have been increased 25 per cent above those given in the Code. The reasons for this increase are that: (1) It is possible to manufacture successfully safety-valve springs capable of these higher lifts; (2) this decreases the number and size of valves required; (3) the large margin of safety secured by restricting the maximum lifts to very low values as in the A. S. M. E. Code is not necessary, since at best the

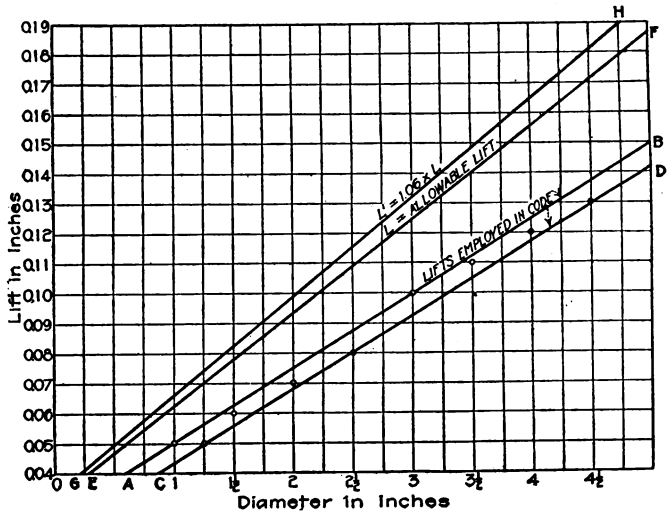


FIG. 15 RELATION OF LIFT OF VALVE TO DIAMETER

safety valve can take care of only a gradual increase in pressure and does not protect against a sudden increase. The chart in Fig. 15 indicates the limits of the maximum lifts employed in constructing the safety-valve tables in the A. S. M. E. Boiler Code where the constant lift is employed for each size of valve regardless of the pressure, and also the suggested lifts 25 per cent greater than the A. S. M. E.

[*Journal*, November 1918, pp. 966-967]

[Source: H. F. Jauss, *Power*, September 17, 1918, pp. 414-417]

## STEAM USES IN THE CANNING FACTORY

The different heat processes in the canning of food point out the need of studying the actual and ideal steam consumptions and methods of minimizing wastes. Assume a plant is equipped to handle 10,000 baskets of tomatoes per day of 12 hours, that they are canned whole and that the skin-and-core pulp is put up as a by-product. A fair value for the yield is seven No. 3 cans of whole

# ENGINEERING DATA

tomatoes per basket and one No. 3 of pulp. This makes a total of 70,000 cans of the former and 10,000 cans of the latter per day of 12 hours.

The useful heat added to the whole tomatoes amounts to 57.5 boiler hp. This is under the assumption that the temperature elevation is 132 deg. The pulp must not only be elevated in temperature but thickened by evaporation of some of its water. Assuming a reduction of 5 to 4, the boiler hp. necessary is 18.5, making a total of 76 boiler bp. for the two products.

Table 13 shows the comparative performance of various evaporators. These values were taken under packing-house conditions and the results cannot be taken to be exact but are considered conservative. The first three lines show the effect of using steam at a lower pressure than 100 lb. and the rate of evaporation in pounds per square foot per hour rapidly falling off to the lower-pressure steam.

Table 14 is intended to show the real advantage of coils. The figures represented are obtained from a number of kettles and coils in actual operation.

The data represented in Table 15 should be taken as only approximately true, as the calculations depend largely upon the assumptions.

TABLE 13 PERFORMANCE OF EVAPORATORS

Type of evaporator	Evaporation, lb. per sq. ft. per hr.	B.t.u. transferred per sq. ft. per hr. per deg. fahr. difference in temperature
Jacketed kettle with 100 lb. steam pressure, by test.....	66.6	660
Jacketed kettle with 50 lb. steam pressure, assuming the same B.t.u. rate of transfer.....	45.0	...
Jacketed kettle with 25 lb. steam pressure.....	29.0	...
Shell evaporator, with paddles, 50 lb. steam pressure, by test.....	41.5	625
Coils, 100 lb. steam pressure, by test.....	60.0	628
Vacuum pan, single effect, 25 lb. steam pressure, on tomato paste; average, by test.....	40.0	313
Vacuum pan, maximum, 100 lb. steam pressure.....	105.0	600
Vacuum pan, with 10 lb. steam pressure, single effect, and 26 in. vacuum.....	64.5	600

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TABLE 14 COMPARISON OF HEATING-SURFACE REQUIREMENTS OF KETTLES AND COILS

Capacity of kettle, gal.....	100	300	500	600 (tank with coil)
Heating surface per gal. of contents, sq. ft.	0.10	0.08	0.06	0.083

TABLE 15 AMOUNT OF HEAT (B.T.U.) REQUIRED FOR PROCESSING IN ONE KETTLE 40 IN. IN DIAM. BY 72 IN. DEEP

	$\frac{1}{2}$ -hr. closed process at 240 deg. fahr.		1-hr. process	
	Dry	Wet	Closed Dry, 216 deg.	Open Wet, 212 deg.
To cans, from 120 deg.....	198,000	198,000	158,000	152,000
To water, from 212 deg.....	0	28,000	0	0(?)
To metal, from 212 deg.....	3,300	3,300	500	0
To vent on top.....	0+	17,500	0+	35,000+
Radiation.....	9,000	9,000	15,300	14,800
Overflow, or drain.....	38,000	46,000	26,000	29,300
Total B.t.u.....	248,300	301,800	199,800	231,100
Boiler hp.....	14.8	18.0	6.00	6.99

[Julian C. Smallwood. Trans., vol. 40, pp. 27-51]

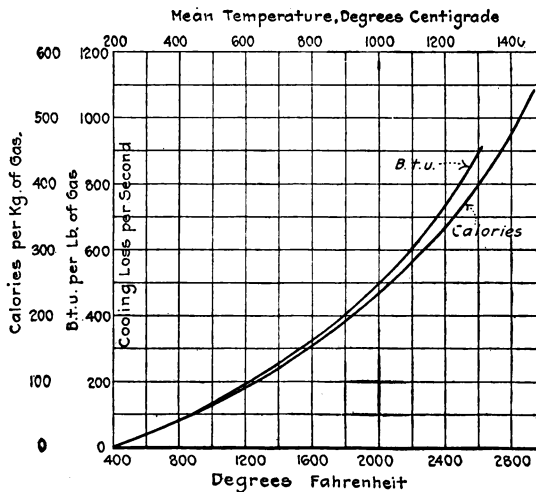
## ENGINEERING DATA

### COOLING LOSSES IN INTERNAL-COMBUSTION ENGINES AS AFFECTING DESIGN

The formula given below was developed from the work of Clerk and others, and with its aid the best speed and dimensions can be estimated for an individual design.

Direct proportionality is assumed between the heat loss per unit of time and the ratio of surface to included volume.

Assume a certain maximum temperature and estimate from the expansion ratio of the engine the temperature drop during the expansion by the use of an assumed polytropic exponent. This will give the mean temperature during expansion as an arithmetic average. The corresponding heat loss  $C$  is read from the curve in Fig. 16 and it is the loss in B.t.u. per pound of calories per kilogram



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FIG. 16 COOLING LOSS PER SECOND AND UNIT WEIGHT OF GAS FOR FULL STROKE IN CLERK EXPERIMENTAL ENGINE

of gas used for an expansion stroke lasting one second. To get the loss for any other duration of stroke it is simply necessary to multiply  $C$  by the actual duration. If the actual r.p.m. is  $N$ , this duration is  $30/N$ . The surface-to-volume ratio in the Clerk engine was 4.64 sq. ft. per cu. ft., and the piston speed at 160 r.p.m.,—the speed at which the curve applies,—586 ft. per min. Consequently, for any engine of surface-to-volume ratio  $R$  and piston speed  $V$  the expansion cooling loss in heat units per unit weight of gas used is

$$L = 0.267 (CR/N) \sqrt{\bar{V}}$$

In this formula  $R$  is expressed in sq. ft. per cu. ft.,  $V$  in ft. per min., and  $N$  in r.p.m., while  $C$  can be either in B.t.u. per lb., or cal. per kg., or in any other units for which  $C$  curve is available. This  $C$ , then, contains and allows automatically for—

- 1 The temperature variation during the stroke.
- 2 The volume variation during the stroke.
- 3 Differences in temperature of combustion and expansion, at least for conditions not differing too much from those of the experimental engine.

Table 16 indicates the heat losses.

## ENGINEERING DATA

TABLE 16 INFLUENCE OF VARYING EXPANSION RATIO ON ENGINES OF THE SAME OUTPUT AND THE SAME SPEED

Volumetric expansion ratio.....	3	5	7	9
Cylinder diameter, in.....	5	4	3.5	3
Stroke, in.....	5	6	7	7.5
Ratio, stroke to bore.....	1	1.5	2	2.5
Surface-to-volume ratio, R, sq. ft. per cu. ft.....	13.3	15.5	16.7	19.0
Piston speed, ft. per min.....	1000	1200	1400	1500
Max. temperature, assumed, deg. fahr.....	3270	3270	3270	3270
Max. temperature, assumed, deg. cent.....	1800	1800	1800	1800
Final temperature of expansion, deg. fahr.....	2240	1850	1630	1470
Final temperature of expansion, deg. cent.....	1227	1007	887	802
Heat loss, B.t.u. per lb. of gas.....	100	103	108	118
Heat loss, cal. per kg. of gas.....	56	57	60	65
Indicated work, approx. B.t.u. per lb. of gas.....	188	248	278	303
Indicated work, approx. cal. per kg. of gas.....	104	138	154	168

Polytropic exponent in computation of temperature drops, 1.3; compression work assumed equal to 30 per cent of expansion work.

[C. A. Norman. *Trans.*, vol. 40, p. 745-761]

## PRINCIPLES OF TRACTOR-ENGINE COOLING

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The data are applicable to motor-engine cooling generally. The principal variables affecting the cooling in addition to the radiator size pertain to radiator type, radiator core, thickness of degree of cooling capacity, rate of water circulation, size, type and speed of fans, and the economic characteristics of the engine to be cooled. For efficient cooling the air must be capable of taking away the heat delivered in the water to the radiator, that is, the heat input minus heat equivalent of horsepower developed and heat losses, divided into two groups, viz., exhaust loss, and engine radiation and convection losses.

$$\text{Heat to radiator} = 0.40 \times \text{heat input} \times F$$

where  $F$  is a variable with the value of 1.0 in the case of L-head engines ranging from 25 to 50 hp. and 0.8 in the case valve-in-head engines of the same power range, both values applicable to tractors. Further, in the case of a tractor the heat loss to the radiator per minute horsepower is equal to about 100 B.t.u. The average heat loss to the radiator in motor-car engine design is assumed to vary from 50 to 60 B.t.u. per min. per hp.

The formula for the frontal area of the radiator in sq. ft. per hp. output of the engine is

$$\text{Area} = \frac{6000}{v(T_4 - T_1)}$$

where  $v$  is the air velocity in ft. per min. and  $T_4 - T_1$  is the temperature rise of air (in deg. fahr.) due to its passage through the radiator.

The tests show (1) that the velocity of flow of water through the radiator is of very great importance, the faster flow producing much better cooling; and (2) that the heat taken up by convection by air increases nearly directly in proportion to the velocity.

[*Journal*, April 1918, pp. 349-350]

[Source: A. B. Modine, *Journal of the Society of Automotive Engineers*, February 1918, pp. 148-151]

## ENGINEERING DATA

### ENTROPY DIAGRAM FOR GASOLINE

Investigation extending over many years used as basis for the diagram given in Fig. 17, for ordinary gasoline of density 0.800 to 0.820 (for water = 1.000). The specific heat can be expressed by the formula  $C = a + bt$ , where  $t$  is temperature in degrees centigrade. Measurements on various gasolines of the same density have given as an average the formula

$$C = 0.50 + 0.0007t$$

As regards the heat of molecular vaporization, the value of  $L/T$  has been determined by comparison with various known organic liquid such as chloroform, acetone, sulphur and chloride of carbon. On plotting the curves, giving  $L/T$  as a function of the absolute pressure, it is found that the average curve represents with sufficient approximation the value of the function for ordinary gasoline. This function has the form  $L/T = a/T - b$ , where  $a$  and  $b$  are constants.

Using the curve of pressures of vapor of ordinary gasoline, the values of  $L/T$  for gasoline as a function of the various temperatures, may be plotted, expressing these values as absolute pressures. In this way the following relation is obtained:

$$L/T = 15,160/T - 12.42$$

Dividing this expression by  $\mu$ , the molecular weight of ordinary gasoline, the heat of vaporization per unit of weight in large calories  $r$ , is obtained, or

$$r/T = 82.4/T - 0.0675$$

or

$$r = 82.4 - 0.0675T$$

The value 184 closely expresses the molecular weight for the various samples of gasoline tested. American gasolines are essentially expressed by the formula  $C_nH_m$ , where  $m = 2n + 2$ , while Russian gasolines correspond to the formula  $C_nH_{2n}$ . Ordinary gasoline is nothing but a mixture and is expressed with sufficient exactness by  $C_{12}H_{28}$ .

With these magnitudes established, the entropy of the liquid is given by the expression

$$\begin{aligned} S_{\text{liq.}} &= \int_0^T \frac{dq}{T} = \int_0^T \left[ 0.50dT + 0.0007(T - 273) \frac{dT}{T} \right] \\ &= 0.3089L_n \left( \frac{T}{273} \right) + 0.0007(T - 273) \end{aligned}$$

The entropy of the saturated vapor is obtained by adding to this expression  $r/T$ , this giving

$$S_{\text{vap.}} = 0.3089L_n \left( \frac{T}{273} \right) + 0.0007T + \frac{82.4}{T} - 0.2586$$

## ENGINEERING DATA

From these formulæ Fig. 17 has been plotted.

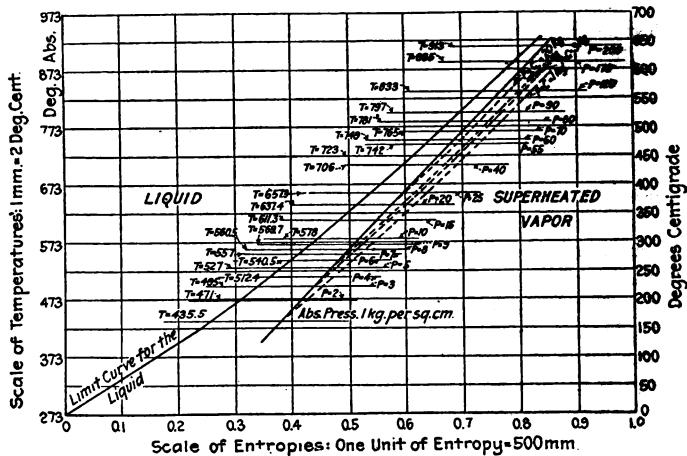


FIG. 17 ENTROPY DIAGRAM FOR GASOLINE

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From the curve of vapor pressures the following expression is deduced, where  $T$  is the absolute temperature of boiling of gasoline expressed as a function of  $T_0$ , which is the absolute temperature of boiling of water at the same pressure:

$$T = 1.167 T_0 - 0.641 (T_0 - 273)$$

The various points in the entropy diagram have been checked up to a pressure of 40 kg. (560 lb. per sq. in.), these checks showing possible errors from 1 to 2 per cent. Inspection of the diagram shows

- 1 That the saturated vapor of ordinary gasoline is superheated through fall of pressure, and
- 2 That the heat of the liquid is always considerably higher than the heat of vaporization.

From these two properties, which are directly opposite to those of water vapor, it follows that when saturated vapor of gasoline is allowed to expand it is simultaneously superheated and produces mechanical work. If liquid gasoline under pressure is allowed to have part of its pressure removed it is partially vaporized, and if this low pressure is maintained for a sufficiently long time, its vapor is superheated.

**These properties are probably common to all the principal hydrocarbons.**

[*Journal*, June 1918, pp. 501-502]

[Source: Jean Rey, *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*,  
March 4, 1918, pp. 387-390]

## ENGINEERING DATA

### REFRIGERATING PLANT EFFICIENCY

The unit 10,000-B.t.u. fuel is used to equalize the value of the various fuels in common use, thus placing them on a common basis. Fig. 18 shows the results to be expected from various types of installations. The allowance made for auxiliaries ranges from one-half to one horsepower per ton of ice, depending upon conditions. The condenser pressure was taken at 185 lb. gage, and it was assumed that at the suction pressure given the machine would operate at about full load.

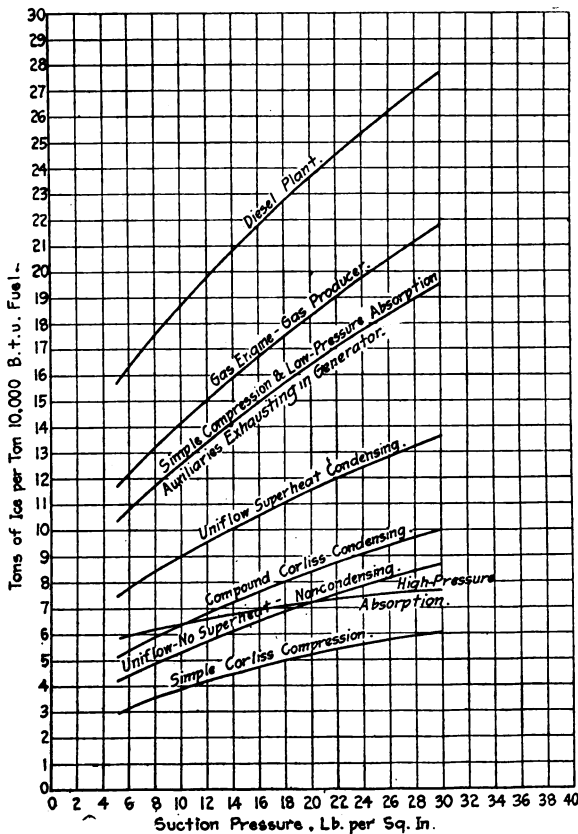


FIG. 18 RELATIVE EFFICIENCY OF VARIOUS ICE-PLANT INSTALLATIONS

In the majority of ice plants the initial steam pressure in the steam cylinder is from 70 to 90 lb. Even in plants having high-pressure boilers the benefit to be derived from high-pressure steam is not usually taken advantage of. Tests show an economy increase of 7.5 per cent by raising the pressure from 75 to 100 lb., and of 4 per cent by raising it from 100 to 125 lb.

## ENGINEERING DATA

One of the most uneconomical auxiliaries, as usually operated, is the air-lift. Fig. 19 shows the performance of properly designed air lifts; the efficiency decreases somewhat as the lift increases, but should not be less than 60 to 80 per cent, whereas actually in some cases it will be found as low as 20 per cent; the trouble is usually too great or too little submergence.

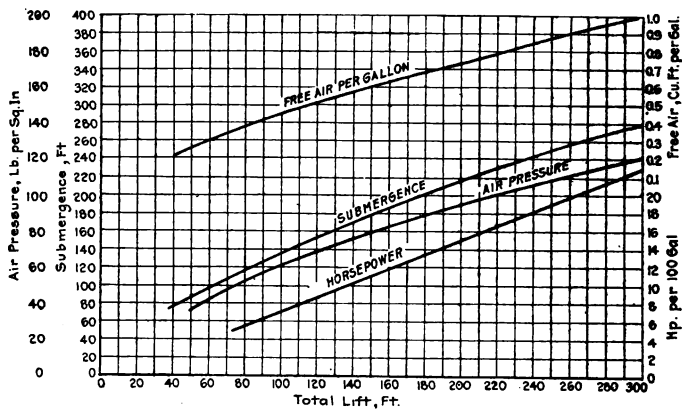


FIG. 19 STANDARD AIR-LIFT PERFORMANCE

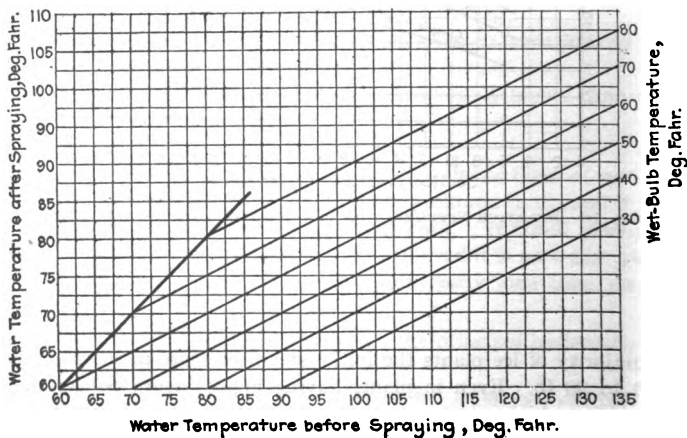


FIG. 20 PERFORMANCE OF SPRAY SYSTEM



## ENGINEERING DATA

**Ammonia Condenser.** There is no reason for a condenser pressure as high as 200 lb. It always indicates improper conditions, and even in a hot climate the condenser pressure should be below 175 lb. In the hottest summer weather and when there is a relatively high wet bulb, the following results are to be expected with properly proportioned installations:

Air temperature.....	100 deg. fahr.
Wet bulb.....	80 deg. fahr.
Water off cooling to wet.....	83 deg. fahr.
Water on ammonia condenser.....	83 deg. fahr.
Water off ammonia condenser.....	88 deg. fahr.
Temperature difference, on and off.....	5 deg. fahr.
Condenser heat transmission.....	150 B.t.u.
Condenser temperature difference.....	7.5 deg. fahr.
Condenser surface per ton.....	26 sq. ft.
Condenser pressure.....	177 lb.

The spray system has recently been introduced in connection with ammonia condensing systems and very good results are being obtained. Its cooling efficiency varies from 45 to 70 per cent, depending on humidity, wind velocity, fineness of spray and pressure at the nozzles. In the calculations which must be made for designing a spray system, however, it is advisable to figure its operating efficiency at 50 per cent. This value has been assumed in the preparation of the curves in Fig. 20, which show the value of the temperature of the water before spraying and the corresponding values after spraying, for various wet-bulb temperatures.

[Victor J. Azbe. *Trans.*, vol. 40, pp. 627-663]

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## EFFECTS OF WATER SCOOPING ON TRAIN RESISTANCES

During passage through the trough the scoop becomes a moving vane and is governed by the same principles as an ordinary turbine, except that impact in the former case is caused by collision of the moving scoop against the stationary volume of water and in the latter case by the moving water against the stationary or slowly moving vane.

Assuming that the scoop is moving at a velocity of  $V$  ft. per sec., and area of the delivery pipe is  $a$  sq. in., then the resultant reaction of the scoop which constitutes the increased resistance of the train is

$$R = \sqrt{2} \times 62.4aV/144g\sqrt{(V^3/2)}$$

The following table is based on area of delivery pipe of 50 sq. in.:

Speed, m.p.h.....	25	30	35	40	45	50	55	60
Resistance, lb.....	901	1310	1779	2330	2940	3610	4320	5220

The relation between resistance and delivery pipe area  $a$  is shown in the following table ( $V = 40$  miles per hour):

$a$ , sq. in.....	35	40	45	50	55	60	65	70
Resistance, lb.....	1631	1860	2100	2320	2560	2800	3040	3260

If these data are plotted as a curve a straight line is obtained, showing that in designing the scoop the minimum area is desirable consistent with the volume of water to be lifted over a given length of trough.

[*Journal*, March 1918, p. 283]

[Source: H. C. Webster, *Railway Engineer*, vol. 39, January 1918, p. 4]

## ENGINEERING DATA

### WINTER TEMPERATURES AND LOCOMOTIVE CAPACITY

A drop in air temperature decreases the capacity of the steam-locomotive boiler and also greatly increases the train resistance, the latter because journal friction increases as the temperature falls, because of the increase in the viscosity of the lubricant. In fact, the first factor appears to be of much less importance than the latter.

Operating records in electric freight service over a distance of about 70 miles, with undulating curves of 0.6 per cent and considerable curvatures, were used to compare the consumption of power in winter with that of summer in a better manner than could have been done with steam locomotives.

"Power-range" and "temperature-range" curves were found and compared. It was found that for each degree of temperature fall the demand for power increases 0.65 per cent. This figure has been found from data secured with electric locomotives, but it is believed that the factor 0.65 per cent may be applied to steam-locomotive service as well, heat losses and engine friction of steam and electric locomotives considered in percentage of maximum capacity being quite similar, and heat losses in steam locomotives causing reduction in capacity in winter as compared with summer being practically offset for the purposes of this study by the consumption of current in heating cabs of electric locomotives, this requiring approximately 3 per cent of the total electric power used on a trip.

On the basis of 0.65 per cent greater power required to move cars for each degree of temperature drop, excess-power requirements in December, 1917, and January, 1918, as compared with those months in the three preceding years were as follows:

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#### December, 1917:

- 4.55 per cent greater than in December, 1914.
- 5.55 per cent greater than in December, 1915.
- 5.95 per cent greater than in December, 1916.

#### January, 1918:

- 8.71 per cent greater than in January, 1915.
- 8.71 per cent greater than in January, 1916.
- 7.15 per cent greater than in January, 1917.

Assuming 800 locomotives normally in service, the result of such handicap, measured in the number of locomotives necessary to make up the increased demand for power on account of low temperature, was as follows:

December, 1917	January, 1918
36.4 engines more than in 1914	69.7 engines more than in 1915
44.4 engines more than in 1915	69.7 engines more than in 1916
47.6 engines more than in 1916	57.2 engines more than in 1917

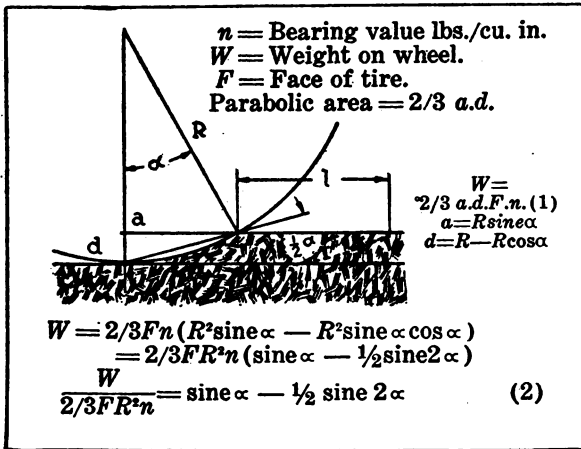
[*Journal*, May 1918, pp. 434-435]

[Source: W. L. Bean, *Railway Age*, March 15, 1918, pp. 539-541]

# RESISTANCE TO ROLLING OF TRACTOR WHEELS IN SOFT GROUND

Tests to determine the relation between rolling resistance, specific load, wheel diameter, speed, and other factors. Financial assistance given by University of Minnesota Research Fund and the Society of Automotive Engineers. Tests thus far conducted were confined to plain, flat-tired wheels of varying weight, width and diameter.

In Fig. 21, Equation [1] expresses approximately the low outline for a cylindrical body for plain, flat-tired wheels, where  $n$  is the load supported by the soil per unit volume displaced. From this is deduced Equation [2], which expresses a similar law in terms of the wheel dimensions and the arc  $\alpha$ , which is in contact with the soil.



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FIG. 21—RESISTANCE TO ROLLING OF A HARD CYLINDRICAL BODY

The following equations are derived through the application of the principle of conservation of energy, by virtue of which it must be true that the work done in rolling a wheel a given distance is equal to that expended in depressing the soil over the same distance.

$$\text{Mean unit pressure} = \frac{W}{FR \sin \alpha} = \frac{2}{3} \text{ maximum unit pressure.}$$

$\therefore$  Max. unit pressure =  $\frac{3}{2} \frac{W}{FR \sin \alpha}$  which varies as depth from zero at the surface.

$$\therefore \text{Work per unit area} = d \times \frac{1}{2} \times \frac{3}{2} \frac{W}{FR \sin \alpha}.$$

Work of depression over distance 1 with resistance  $P$  is  $\frac{3}{4} \frac{W}{FR \sin \alpha} dFl = Pl$ .

$$\therefore \frac{P}{W} = \frac{3}{4} \frac{d}{FR \sin \alpha} = \frac{3}{4} \text{ slope of chord} = \frac{3}{4} \tan \frac{1}{2} \alpha \text{ or } G = \frac{P}{W} = \frac{3}{4} \tan \frac{1}{2} \alpha.$$

In the following equations  $P$  represents resistance or pull required to roll the wheel, and this divided by the weight of the wheel is  $G$ , or Equivalent Grade,

## ENGINEERING DATA

which is the percentage grade, such that if the wheel rolled upward without friction on a hard surface it would give the same resistance as  $P$

$$\cos \alpha = \sqrt{\frac{2P}{FR^2n}} - 1$$

$$d = R - R \cos \alpha$$

$$d = \sqrt{\frac{2P}{Fn}}$$

$$P = \frac{1}{2} d^2 Fn$$

Or resistance depends upon depth of depression, face of tire and soil factor, irrespective of diameter and weight.

Knowing the soil flow and bearing value,  $P$  could be determined from the track alone.

The value given above, or  $\frac{3}{4} \tan \frac{1}{2} \alpha$ , or three-quarters of the slope of the chord subtending the arc of contact, is a much smaller quantity than some of the data previously published on loss in rolling a round wheel would lead one to believe.

Referring again to Equation [2] in the above figure, it is evident that the factors in the denominator other than  $n$  are proportional to the cylindrical volume of the wheel, which may be called  $Q$ . In the calculations this has been expressed in cubic feet, so that  $W/Q$ , which is designated as  $S$ , or specific load, is written in pounds weight per cubic foot of wheel volume, and it is proved mathematically that there is a fixed relation between  $S$  and  $G$  whenever  $n$  remains constant. It is shown that resistance depends upon the depth of depression, face of tire and soil factor, but is independent of diameter and weight. Hence, knowing the soil flow and bearing value,  $P$  can be determined from the track alone. In other words, if we know anything about the soil, that is, if we know  $n$ , we can tell the resistance of a wheel even if we have never seen anything but the track.

[*Journal, July 1918, pp. 592-593*]

[Source: A. F. Moyer, Mem. Am. Soc. M. E., *Automotive Industries*, vol. 38, no. 2, May 16, 1918, pp. 949-953]

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## THE DIVERGENCE OF STEAM NOZZLES

In expanding adiabatically from a pressure  $p_1$  to a pressure  $p_0$  the velocity of steam is

$$C_0^2 = 2gH_1 \frac{\gamma}{\gamma - 1} \left( 1 - z^{\frac{\gamma-1}{\gamma}} \right)$$

where

$$z = \frac{p_0}{p_1}, \text{ and } H_1 = 144 p_1 V_1$$

At the throat

$$z_t = \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma}{\gamma - 1}}, \text{ where } z_t = \frac{p_t}{p_1},$$

so that at the throat

$$C_t^2 = 2gH_1 \frac{\gamma}{\gamma + 1} \dots \dots \dots [1]$$

## ENGINEERING DATA

If  $A_t$  is the area of the nozzle at the throat, and  $A_o$  that of the exit, the equation for continuity gives

$$\frac{A_o}{A_t} = \frac{C_t V_o}{C_o V_t} \dots\dots\dots [2]$$

where  $V_t$  and  $V_o$  are the volumes of the steam at the throat and exit of the nozzle, respectively.

As  $p_o V_o^\gamma = P_t V_t^\gamma$

and as

$$p_t = p_1 z_t = p_1 \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma}{\gamma - 1}} \dots\dots\dots [3]$$

we have

$$\frac{V_o}{V_t} = \left( \frac{p_t}{p_o} \right)^{\frac{1}{\gamma}} = \left( \frac{2}{\gamma + 1} \right)^{\frac{1}{\gamma - 1} z} + \frac{1}{\gamma} \dots\dots\dots [4]$$

Putting Equations [1], [2] and [4] into [5], we have

$$\frac{A_o^2}{A_t^2} = \frac{\gamma - 1}{2} \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma + 1}{\gamma - 1}} \frac{1}{z^{\frac{2}{\gamma} - z} \frac{\gamma + 1}{\gamma}} \dots\dots\dots [5]$$

as an equation for the flare of the nozzle.

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As  $z$  is fractional, a more convenient form for calculation is obtained by writing  $X = \frac{1}{z} = \frac{p_1}{p_o}$ ,  $X$  being the expansion by pressure; and then [5] becomes

$$\frac{A_o^2}{A_t^2} = \frac{\gamma - 1}{2} \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma + 1}{\gamma - 1}} \frac{X^{\frac{\gamma + 1}{\gamma}}}{X^{\frac{\gamma - 1}{\gamma}} - 1}$$

As the ratio of the specific heats, or  $\gamma$ , may be considered as practically constant in these equations for the adiabatic expansion of steam, the flare depends only upon the amount of expansion by pressure in the nozzle; that is, it is the same for a nozzle expanding from 200 lb. per sq. in. to 20 lb. as from 10 lb. to 1 lb.

For the critical expansion  $z = \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma}{\gamma - 1}}$ , the value of  $A_o/A_t$  is unity;

and for ordinary values of  $\gamma$ , 1.135 for saturated steam of 1.3 for superheated steam, the relation between the flare and the ratio of expansion in the nozzle is approximately a straight line, except for large degrees of expansion.

In the common case, where the steam is at first superheated and then becomes wet as it expands, the average value of  $\gamma$  is between the value for superheated steam, 1.3, and that for saturated steam, 1.135.

The following figure shows relation between the flare and the amount of expansion for saturated and superheated steam, and also for air. In this diagram "divergence" is to be understood as the ratio of area at any section of the nozzle to the throat area. In practice nozzles are generally given less flare, since it is much more important to have too little flare than too much flare.

## ENGINEERING DATA

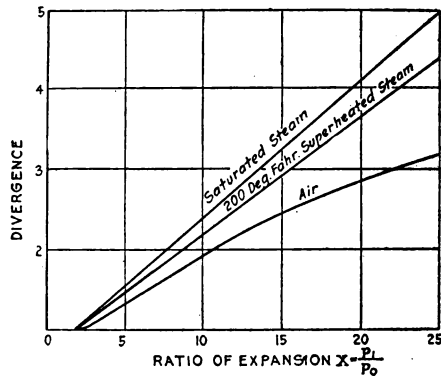


FIG. 22—THEORETICAL DIVERGENCE OF STEAM NOZZLES

Generally friction in a nozzle slightly increases the flare, but in practice this is negligible.

The following figure shows a combination of curves given by W. J. Goudie from an analysis of data published by Dr. Steinmetz.

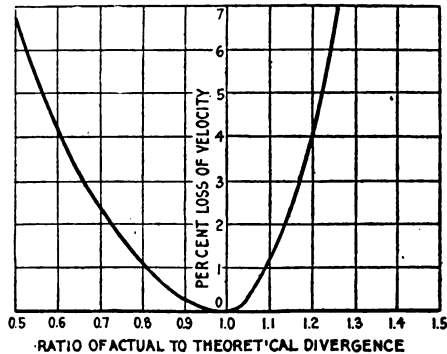


FIG. 23—RATIO OF ACTUAL TO THEORETICAL DIVERGENCE

H. M. Martin points out that

$$\frac{\lambda}{\lambda - 1} = \frac{1}{\eta} \frac{\gamma}{\gamma - 1}$$

where  $\lambda$  is, for frictional flow, the apparent value of the index in  $pV^\lambda = \text{constant}$ , and  $\eta$  is the efficiency. For many purposes this formula is more conveniently written as

$$1 - \frac{1}{\lambda} = \eta \left( 1 - \frac{1}{\gamma} \right)$$

As in practice the efficiency is always above 90 per cent, it is easily seen that the losses in the nozzle have little effect on the flare.

[*Journal, February 1918, pp. 202-203*]

[Source: Gerald Stoney, *Engineering*, vol. 104, no. 2710, December 7, 1917, p. 597]

**DIRECTORY SECTION  
PART I**

**Consulting Engineers'  
Directory**

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Compiled from returns received from the membership of  
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Franz, Walter G., Union Trust Bldg., Cincinnati, O.

Hanscom, William W., 848 Clayton St., San Francisco, Cal.

Hardesty, Frederick S., Commercial Natl. Bank Bldg., Washington, D. C.

Harris, Ford W., 933 Higgins Bldg., Los Angeles, Calif.

Hatch, Edwin G., 120 Broadway, New York.

Hollis French and Allen Hubbard, 88 Pearl St., Boston, Mass.

Hoxie, Geo. L., 50 East 41st St., New York.

Humphrey, C. W., 327 S. La Salle St., Chicago, Ill.

Hutchinson, Cary T., 65 W. 54th St., New York.

Industrial Engineers Corp., Suite 920, Victoria Bldg., St. Louis, Missouri.

Jacobson, Ernst, 206 E. Fourth St., Davenport, Ia.

Jammer, Edwin W., 160 Broadway, New York.

Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.

Pillsbury Co., Charles L., 2305 Oliver Ave., S., Minneapolis, Minn.

Place, Clyde R., Grand Central Terminal, New York.

Republic Engineers, Inc., 60 Broadway, New York.

Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.

Sanderson & Porter, 52 William St., New York.

Sawford, Frank, 1201 Georgia St., Vancouver, B. C.

Sawtelle, E. M., 5 Beekman St., New York.

Scott, Arthur C., 1816 1/2 Main St., Dallas, Texas.

Sessions, Frank L., Rockefeller Building, Cleveland, Ohio.

Smith, Harold B., Worcester Polytechnic Inst., Worcester, Mass.

Stebbins, Theodore, 34 Gramercy Park, New York.

Sutton, Frank, 80 Broadway, New York.

Taylor, Percy B., Esser Bldg., Newark, N. J.

Thomas, Percy H., 120 Broadway, New York.

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

Vaughan, John F., 185 Devonshire St., Boston, Mass.

Waters, W. L., 150 Nassau St., New York.

Westcott & Mapes, Inc., 207 Orange St., New Haven, Conn.

Westinghouse, Church, Kerr & Co., 37 Wall Street, New York.

Whipple, George Francis, Allston Square, Boston, Mass.

White Engineering Corp., J. G., 43 Exchange Place, New York.

Whiting, Charles W., 148 State St., Boston, Mass.

Yaeger, Harry G., 507 W. Jackson Building, Chicago, Illinois.

**ELECTRICAL INSTALLATIONS**

Acheson, A. R., 852 Ostrom Ave., Syracuse, N. Y.

**ELECTRICAL MACHINERY** (Designing)

Adams, C. A., Harvard University, Cambridge, Mass.

**ELEVATORS** (See also Grain)

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

**ENGINES**

—Gas

Dock, Herman, Engineers' Club, New York.

—Gas (Designing)

Shaw, Louis E., 1926 Broadway, New York.

—Internal Combustion

Lucke, Charles E., Columbia University, New York.

—Uniflow

Swartwout, Everett W., 20 Lafayette St., White Plains, New York.

**EQUIPMENT** (See also Building, Chemical Works, Die Sinking, Coke Plants, Projectile Producing, Railway Sprinkler)

Buckley, John H., Box 335, Yonkers, N. Y.

Colwell, James V. V., 105 W. 40th St., New York.

—Electrical

Schloss, Newton L., 351 W. 143rd St., New York.

**EVAPORATORS**

Honolulu Iron Works Co., Woolworth Bldg., New York.

Mantius, Otto, 233 Broadway, New York.

**EXAMINATION & REPORTS** (See also Investigations)

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

Brinton, Willard C., 17 W. 44th St., New York.

Cary, Albert A., 95 Liberty St., New York.

Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

Fletcher, E. L., 1089 Broad St., Fletcher-Thompson, Inc., Bridgeport, Conn.

**EXAMINATION & REPORTS** (Continued)

Holland, Ackerman & Holland, Lawrence Bldg., Ann Arbor, Mich.  
 Kaighn, Herbert E., 2600 Harrison St., Wilmington, Del.  
 White Engineering Corp., J. G., 43 Exchange Place, New York.

**EXPERIMENTAL**

Kaighn, Herbert E., 2600 Harrison St., Wilmington, Del.

**F****FACTORIES** (See also Sugar)**—Construction**

Bennett, Wilmer C., 327 S. La Salle St., Chicago, Ill.  
 Chase, Inc., Frank D., 645 North Michigan Avenue, Chicago, Illinois.  
 Ferguson, H. S., 200 Fifth Ave., New York.

**—Layout**

Dollar, W. M., Buffalo, N. Y.

**—Management**

Lloyd, Robert M., 347 Madison Ave., New York.

**—Organization**

Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Hubbard & Harris, P. O. Box 1003, Bridgeport, Conn.

**—Planning**

Cundall, Robert N., Pres., Cundall, Powell & Mosher, Inc., 80 W. Genesee St., Buffalo, N. Y.

**—Sprinkler Equipment**

Hoagland, Ira G., 80 Maiden Lane, New York.

**FIELD RESEARCH WORK**

Fowler, Geo. L., 120 Liberty St., New York.  
 Peterson & Co., Frank P., 535 N. Cheyenne St., Tulsa, Okla.

**FILTRATION PLANTS****—Chemical**

Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

**—Sugar**

Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

**—Wax**

Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

**FIRE PREVENTION**

Ancona, John F., Cutler Bldg., Rochester, N. Y.  
 Davis, Charles Ethan, 885 West End Ave., New York.

Hoagland, Ira G., 80 Maiden Lane, New York.  
 Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

**FLOUR MILLING PLANTS**

Ingraham, Alexander, Calgary, Alberta, Canada.

**FLOW METERS**

Gibson Co., Geo. H., Tribune Bldg., New York.

**FORGE SHOPS**

Ellis, Frank I., 2126 Farmers Bank Bldg., Pittsburgh, Pa.

**FORGING MACHINES**

Loss, Henrik V., Witherspoon Bldg., Philadelphia, Pa.

**FOUNDATIONS**

Burr, William H., 120 Broadway, New York.  
 Moran, Daniel E., 55 Liberty St., New York.

**FOUNDRY PLANTS** (See also Iron Foundry)

Carliss, Oswald T., Plainfield, N. J.  
 Hardy, Clement A., Rm. 654, Railway Exchange Bldg., Chicago, Ill.

Lane Co., H. M., 701 Owen Bldg., Detroit, Mich.

Moldenke, Dr. Richard, Watchung, N. J.  
 Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.

Robinson, Louis G., 31 E. 4th St., Cincinnati, O.

**FURNACES, INDUSTRIAL**

Cary, Albert A., 95 Liberty St., New York.  
 Meade & Co., Richard K., 11 E. Fayette St., Baltimore, Md.  
 Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.  
 Schwab, Gustav, 525 Market St., San Francisco, Cal.

**G****GAS** (See also Natural Gas, Testing)

Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Garland, C. M., 1049 Ardmore Ave., Chicago, Ill.

Humphreys & Miller, Inc., 165 Broadway, New York.

Polk, Roger W., 193 Washington Ave., Providence, R. I.

Steere Engineering Co., Detroit, Mich.

Unger, John S., 3344 Broadway, Chicago, Ill.

**GAS AND OIL**

Scott, Arthur C., 1816½ Main St., Dallas, Texas.

**GASOLINE EXTRACTION PLANTS**

Bertsch, John C., 1164 North Main St., Tulsa, Okla.

Hope Engineering & Supply Co., Mt. Vernon, Ohio.

**GASOLINE FROM NATURAL GAS**

Peterson & Co., Frank P., 535 N. Cheyenne St., Tulsa, Okla.

**GASOLINE PLANTS**

Fink, J. B., P. O. Box 578, Tulsa, Okla.

**GAS WASHING**

Frey, Bassett & Co., 122 S. Michigan Ave., Chicago, Ill.

Meade & Co., Richard K., 11 E. Fayette St., Baltimore, Md.

**GEOLOGICAL**

Scott, Arthur C., 1816½ Main St., Dallas, Texas.

**GRAIN ELEVATORS**

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

**GYPSUM PLANTS**

Brown, Holcombe J., Box 101, Ridley Park, Pennsylvania.

**GYROSCOPIC**

Norden, Carl L., 375 Fulton St., Room No. 50, New York.

**H****HANDLING AND PACKING MACHINERY**

Neale, William McC., P. O. Box 351, Greensboro, North Carolina.

**HEATING**

Boomhower, F. K., 216 Burlingame, Detroit, Mich.

Franz, Walter G., Union Trust Bldg., Cincinnati, O.

Landvoigt, Thomas E., 1007 Monroe St., N. W., Washington, D. C.

Little & Shepard, 2033 Dime Bank Bldg., Detroit, Mich.

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

Stevens, John A., 8 Merrimack St., Lowell, Mass.

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

**HEATING AND VENTILATING**

Acheson, A. R., 852 Ostrom Ave., Syracuse, N. Y.

Allan, Charles D., 1732 S. Michigan Blvd., Chicago, Ill.

Ancona, John F., Cutler Bldg., Rochester, N. Y.

Ballinger & Perrott, N. W. Cor. 17th and Arch Sts., Philadelphia, Pa.

Briner, E. A., 370 Central Ave., E. Orange, N. J.  
Carr, Inc., E. W., 425 Gravier St., New Orleans, La.

Cary, Albert A., 95 Liberty St., New York.  
Cundall, Robert N., Pres., Cundall, Powell & Mosher, Inc., 80 W. Genesee St., Buffalo, N. Y.  
English Co., William T., 308-10 Dover St., Boston, Mass.

Hoffman, J. D., Purdue University, Lafayette, Ind.

Hollis French & Allen Hubbard, 88 Pearl St., Boston, Mass.

Kimball, D. D., 15 W. 38th St., New York.  
MacLeod, Norman M., 39 W. Loudon St., Germantown, Philadelphia, Pa.

McCann, Frank G., Room 515, Municipal Bldg., New York.

McHollan, James A., 55 Liberty St., New York.  
Pillsbury Co., Charles L., 2305 Oliver Ave., S., Minneapolis, Minn.

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

Prather, H. B., 664 Rockefeller Bldg., Cleveland, O.

Richmond Engineering Co., Richmond, Va.

Riley, C. L., Clark, MacMullen & Riley, Inc., 101 Park Ave., New York.

Taylor & Downes, 301 Gaston Bldg., Dallas, Tex.

Taylor, Percy B., Essex Bldg., Newark, N. J.

#### HEATING SYSTEMS

##### —Vacuum

English Co., William T., 309-10 Dover St., Boston, Mass.

Scrivenor, Arthur, 714 Mutual Bldg., Richmond, Va.

#### HEAT TREATING

Schwab, Gustav, 525 Market St., San Francisco, Calif.

#### HOISTING (See also Conveying)

Buckley, John H., Box 335, Yonkers, N. Y.  
Horton, John T., 242 Bradhurst Ave., New York.

#### HOT WATER

Allan, Charles D., 1732 S. Michigan Blvd., Chicago, Ill.

English Co., William T., 308-10 Dover St., Boston, Mass.

#### HOTELS

Place, Clyde R., Grand Central Terminal, New York.

#### HYDRAULIC

Allen, Charles M., Worcester Polytechnic Inst., Worcester, Mass.

Beaubien, James A., 50 E. 42nd St., New York.

Brown & Co., Edward C., 220 Devonshire St., Boston, Mass.

Burr, William H., 120 Broadway, New York.

Carver, Fred S., 8 West 40th St., New York.

Cooper, Hugh L., 101 Park Ave., New York.

Groat, B. F., 2400 Oliver Bldg., Pittsburgh, Pa.

Hale, Richard A., Essex Co., Lawrence, Mass.

Holland, Ackerman & Holland, Lawrence Bldg., Ann Arbor, Mich.

Hollis French & Allen Hubbard, 88 Pearl St., Boston, Mass.

Hornung, Geo., 512 Fairfield Ave., Bellevue, Ky.

Hurd, Charles H., 1405 Merchants Bank Bldg., Indianapolis, Ind.

Johnson, R. D., 60 Wall St., New York.

Landreth, Olin H., 156 5th Ave., New York.

Safford, Arthur T., 66 Broadway, Lowell, Mass.

Scott, Arthur C., 1816½ Main St., Dallas, Texas.

Sherman, Walter P., 1407 Singer Bldg. (149 Broadway), New York.

Switzer, John A., University of Tenn., Knoxville, Tenn.

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

Vaughan, John F., 185 Devonshire St., Boston, Mass.

White Engineering Corp., J. G., 43 Exchange Place, N. Y.

#### HYDRAULIC MACHINERY

Carver, Fred S., 8 West 40th St., New York.

Loss, Henrik V., Witherspoon Bldg., Philadelphia, Pa.

Wood, Wm. H., 10 South Ave., Media, Va.

#### HYDRAULIC MEASUREMENTS

Safford, Arthur T., 66 Broadway, Lowell, Mass.

#### HYDRAULIC SHELL FORGING

Davis, Charles Ethan, 885 West End Ave., New York.

**HYDRO-ELECTRIC** (See also Power Plants, Hydro-electric)

Hurd, Charles H., 1405 Merchants Bank Bldg., Indianapolis, Ind.

#### HYDRO-ELECTRIC DEVELOPMENT

Ferguson, H. S., 200 Fifth Ave., New York.

Holland, Ackerman & Holland, Lawrence Bldg., Ann Arbor, Mich.

Hoxie, Geo. L., 50 East 41st St., New York.

Vaughan, John F., 185 Devonshire St., Boston, Mass.

## I

#### ILLUMINATING

Le Page, C. B., Stevens Institute of Technology, Hoboken, N. J.

#### INDUSTRIAL

Almert, Harold, 209 S. La Salle St., Chicago, Ill.

Ancona, John F., Cutler Bldg., Rochester, N. Y.

Breslove, Jos., Oliver Bldg., Pittsburgh, Pa.

Brown, Wendell S., 1009 Hospital Trust Bldg., Providence, R. I.

Camp, Eugene V., Box 421, Atlanta, Ga.

Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.

Chase, Inc., Frank D., 645 North Michigan Avenue, Chicago, Illinois.

Collins, Francis W., 50 Church St., New York.

Cooley-Marvin Co., 711 Tremont Bldg., Boston, Mass.

Cravens, George W., Westfield, N. J.

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.

Edgar, O. N., 5825 De Giverville Ave. (Temporary), St. Louis, Mo.

Estes, Inc., L. V., 202 So. State St., Chicago, Ill.

Farnham, Dwight T., 3rd Natl. Bank Bldg., St. Louis, Mo.

Firestone, Sigmund, Granite Bldg., Rochester, New York.

Fletcher, E. L. (Fletcher-Thompson, Inc., 1089 Broad St.), Bridgeport, Conn.

Freyn, Bassett & Co., 122 S. Michigan Ave., Chicago, Ill.

Griswold, H. J., 320 Laganchetien St., W., Montreal, P. Q.

Halbfass, Arnold J., 11 Nischeweg, Berne, Switzerland.

Haselton, Edgar C., 2034 Northampton St., Holyoke, Mass.

Kaighn, Herbert A., 2600 Harrison St., Wilmington, Del.

Koch, William H., Jr., 511 Security Bldg., Bridgeport, Conn.

Meade & Co., Richard K., 11 E. Fayette St., Baltimore, Md.

Moore, Harold T., 611 Chestnut St., Philadelphia, Pa.

Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.

Ott, Albert J., 32 N. Clinton St., Chicago, Ill.

Parks & Son, Byron E., 509 Grand Rapids Saving Bank Bldg., Grand Rapids, Michigan.

Porter, Holbrook F. J., 200 5th Ave., New York.

Prather, H. B., 664 Rockefeller Bldg., Cleveland, O.

**INDUSTRIAL (Continued)**

Railway & Industrial Engrs., Inc., 25 Broad St., New York.  
 Randolph, L. S., Govans, Baltimore, Md.  
 Riley, C. L., Clar, MacMullen & Riley, Inc., 101 Park Ave., New York.  
 Scovell, Clinton H., 110 State St., Boston, Mass.  
 Scrivenor, Arthur, 714 Mutual Bldg., Richmond, Va.  
 Sheldon & Son, F. P., 1009 Hospital Trust Bldg., Providence, R. I.  
 Shepard, George H., Navy Yard, Norfolk, Va.  
 Taggart, James M., 1328 Broadway, New York.  
 Thompson, Inc., Uldric, Jr., 120 Broadway, New York.  
 Wallace & Co., Joseph H., 5 Beekman St., New York.  
 White Engineering Corp., J. G., 43 Exchange Place, New York.  
 Wood, Albert C., Stock Exchange Bldg., Philadelphia, Pa.  
 Wrentmore & Reynolds, Manila, P. I.

**INDUSTRIAL PLANTS**  
 Cannon-Swenson Co., 940 Monadnock Block, Chicago, Ill.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Engel Sr., Construction Co., Godfrey, 17 Battery St., New York.  
 Haven, H. M., & Crosby, Wm. W., 40 Court St., Boston, Mass.  
 Hollis French, & Allen Hubbard, 88 Pearl St., Boston, Mass.  
 Kent, R. S., Pres., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.  
 Lane Co., H. M., 701 Owen Bldg., Detroit, Mich.  
 Main, Charles T., 201 Devonshire St., Boston, Mass.  
 Place, Clyde R., Grand Central Terminal, New York.  
 Vaughan, John F., 185 Devonshire St., Boston, Mass.  
 Viola, Bartholomew, 309 Broadway, New York.

—**Equipment (Hydraulic)**  
 Eastern & Machinery Equipment Co., Inc., 1036 Commercial Trust Bldg., Philadelphia, Pa.

**INDUSTRIAL RELATIONS** (See also Arbitration)  
 Calder, John, 25 Merriam St., Lexington, Mass.

**INLAND WATERWAYS**  
 Bennett, Howard D., 2114 Allendale St., Baltimore, Md.  
 Godfrey, Hollis, 32nd & Chestnut Sts., Philadelphia, Pa.

**INSPECTION**  
 Bennett, Howard D., 2114 Allendale St., Baltimore, Md.  
 Clark, Frank H., 15 Park Row, New York.  
 Conard, W. R., Burlington, N. J.  
 Eastern Machinery & Equipment Co., Inc., 1036 Commercial Trust Bldg., Philadelphia, Pa.  
 Gebhardt, G. F., Armour Inst. of Tech., Chicago, Ill.  
 Lea, E. S., 229 Chestnut Ave., Trenton, N. J.  
 Lovell, Alfred, 619 Harrison Bldg., Philadelphia, Pa.

**INSULATING MATERIALS**  
 Pike, Robert D., 74 New Montgomery St., San Francisco, Cal.

**INVENTIONS**  
 Neale, William McC., P. O. Box 351, Greensboro, N. C.

—**Development**  
 Sessions, Frank L., Rockefeller Bldg., Cleveland, O.

**INVESTIGATIONS** (See also Examinations and Reports)  
 Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Cary, Albert A., 95 Liberty St., New York.  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Davis, Charles Ethan, 885 West End Ave., New York.

Harris, Harry E., P. O. Box 852, Bridgeport, Conn.  
 Perkins, George H., 77 Mansur St., Lowell, Mass.  
 —**Public Utilities**  
 Polakov, Walter N., 31 Nassau St., New York.

**IRON FOUNDRY**  
 Moore, Edwin A., Foot of Robeson St., Reading, Pa.

**K****KILNS**

—**Lime**  
 Meade & Co., Richard K., 11 E. Fayette St., Baltimore, Md.  
 —**Oil Extracting**  
 Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.  
 —**Reduction**  
 Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.  
 —**Revivifying**  
 Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

**L****LABOR** (See also under Power Plants)

Railway & Industrial Engineers, Inc., 25 Broad St., New York

**LAND RECLAMATION**

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

**LAYOUT**—**Marine Plants**

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

**LEAD-LINED APPARATUS**

Viola, Bartholomew, 309 Broadway, New York.

**LIGHTING**

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

Stevens, John A., 8 Merrimack St., Lowell, Mass.

**LUBRICATION**—**Internal Combustion Engine**

White, E. Milton, Baker-Detwiler Bldg., Los Angeles, Cal.

**M****MACHINE TOOLS**

Eastern Machinery & Equipment Co., Inc., 1036 Commercial Trust Bldg., Philadelphia, Pa.

—**Manufacture**

Davis, Charles Ethan, 885 West End Ave., New York.

**MACHINE DESIGNING**

Adler, Alphonse A., 85 Livingstone St., Brooklyn, N. Y.

Brown, Herman E., 115 Broadway, New York

Bryant, Geo. F., 1025 S. Menard Ave., Chicago, Ill.

Cummings, Henry H., 100 High St., Boston, Mass.

Cundall, Robert N., Pres., Cundall, Powell & Mosher, Inc., 80 W. Genesee St., Buffalo, N. Y.

Dock, Herman, Engineers' Club, New York.

Dollar, W. M., Buffalo, N. Y.

Ferimer, E. J., College Station, Tex.

Furman, F. De R., Stevens Inst. of Tech., Hoboken, N. J.

Gooding, Charles S., 27 School St., Boston, Mass.  
 Harris, Ford W., 933 Higgins Bldg., Los Angeles, Cal.  
 Harris, Harry E., P. O. Box 852, Bridgeport, Conn.  
 Knight, Bernard O., Liberty & De Kalb Sts., Dayton, O.  
 Krummel, Louis C., 488 Nostrand Ave., Brooklyn, N. Y.  
 Neale, William McC., P. O. Box 351, Greensboro, N. C.  
 New Era Machinery Designing Co., 215 Parkway Bldg., Philadelphia, Pa.  
 Norden, Carl L., 375 Fulton St., Room 50, New York.  
 Penney, Harold D., 9 Murray St., New York.  
 Rautenstrauch, Walter, Columbia University, N. Y.  
 Ryther, Geo. D., Carthage, N. Y.  
 Scrivener, Arthur, 714 Mutual Bldg., Richmond, Va.  
 Shaw, Louis E., 1926 Broadway, New York.  
 Sintz, Claude, 311 Marquette Bldg., Detroit, Mich.  
 Slocum, Avram & Slocum, Laboratories, Inc., Woolworth Bldg., New York.  
 Waite, Lorenzo E., 2714 Brentwood Ave., Toledo, O.  
 Wunsch & Washburn, 487 Broadway, New York.

**MAGNESITE PRODUCTS**

Pike, Robert D., 74 Montgomery St., San Francisco, Cal.

**MANAGEMENT** (See also Factories, Power Plants, Public Utilities, Shop)

Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Baher, Wm. H., 120 Broadway, New York.  
 Bartlett, D. Dana, 44 W. 44th St., New York.  
 Calder, John, 25 Merriam St., Lexington, Mass.  
 Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.  
 Case, William L., 17 Battery Place, New York.  
 Cooley-Marvin Co., 711 Tremont Bldg., Boston, Mass.  
 Cummings, L. T., Drefs, Cummings & Drefs, Book Bldg., Detroit, Mich.  
 Davis, Charles Ethan, 885 West End Ave., New York.  
 Dock, Herman, Engineers' Club, New York.  
 Feiss, Richard A., 2149 W. 53rd St., Cleveland, O.  
 Fleming, Henry S., 1 Broadway, New York.  
 Gantt, Henry L., 2905 Singer Bldg., New York.  
 Gilbreth, Inc., Frank B., 77 Brown St., Providence, R. I.  
 Hall, Keppeler, 1109 Finance Bldg., S. Penn Sq., Philadelphia, Pa.  
 Hannah, Frederick A., 32 W. 40th St., New York.  
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 Keely, Royal R., 10 E. 103rd St., New York.  
 Lichtner, William O., 136 Federal St., Boston, Mass.  
 Polakov, Walter N., 31 Nassau St., New York.  
 Railway & Industrial Engrs., Inc., 25 Broad St., New York.  
 Rautenstrauch, Walter, Columbia University, New York.  
 Shepard, George H., Navy Yard, Norfolk, Va.  
 Slocum, Avram & Slocum Laboratories, Inc., Woolworth Bldg., New York.  
 Stewart, R. L., 101 Park Ave., New York.  
 Thompson & Lichtner, 136 Federal St., Boston, Mass.  
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 Rautenstrauch, Walter, Columbia University, New York.

**MANUFACTURING PROCESSES**

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**MARINE** (See also Naval)

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.  
 Hardesty, Frederick S., Commercial Nat'l Bank Bldg., Washington, D. C.  
 Orr, Alexander M., 52 Broadway, New York.

**MARINE SURVEYING**

Mason, Earl P., 2-4 Stone St., New York  
 Wilson, James A., 2-4 Stone St., New York.

**MECHANICAL**

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 Adler, Alphonse A., 85 Livingstone St., Brooklyn, N. Y.  
 Allan, Charles D., 1732 S. Michigan Blvd., Chicago, Ill.  
 Allen, Albert M., 1900 Euclid Ave., Cleveland, O.  
 Allen, W. D., 951 Stuart Bldg., Seattle, Wash.  
 Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Alsberg, Julius, Marquette Bldg., Chicago, Ill.  
 American Industrial Engrg. Co., Monadnock Block, Chicago, Ill.  
 Ancona, John F., Cutler Bldg., Rochester, N. Y.  
 Anderson, F. Paul, Dean College of Engrg., University of Kentucky, Lexington, Ky.  
 Arizpe, Emilio, Apartado 66, Saltillo, Coah, Mexico.  
 Austin, Wm. A., Del Prado Hotel, Chicago, Ill.  
 Bagg, S. F., 251 River St., Troy, N. Y.  
 Baher, Wm. H., 120 Broadway, New York.  
 Ballinger & Perrot, N. W. Cor. 17th & Arch Sts., Philadelphia, Pa.  
 Barkeley, James T., 911 Central Bldg., Los Angeles, Cal.  
 Barlow, F. C., 438 Hudson St., Eau Claire, Wis.  
 Barnaby, Chas. W., 257 Hamilton Ave., Staten Island, N. Y.  
 Barnes, William O., 770 Main St., Leominster, Mass.  
 Barrett, William F., 30 E. 42nd St., New York.  
 Barri, Joel G., 354 Ocean Ave., Brooklyn, N. Y.  
 Baum, Frank G., 1901-2 Hobart Bldg., San Francisco, Cal.  
 Baxter, Burke M., 711 Union Bldg., Cleveland, O.  
 Becker, Adolf J., 1557 Lee St., Charleston, W. Va.  
 Behr, H. C., 2 Rector St., New York.  
 Bell, David, 1555 Fillmore Ave., Buffalo, N. Y.  
 Bell, John E., 111 Broadway, New York.  
 Bendit, Louis, T. B. Gasoline Co., Tulsa, Okla.  
 Benjamin, C. H., Purdue University, Lafayette, Ind.  
 Bennett, Howard D., 2114 Allendale St., Baltimore, Md.  
 Bentley & Holmgren, 406 Court Exchange Bldg., Bridgeport, Conn.  
 Beranger, Jos. P., 129 Front St., New York.  
 Bernner, Milton St. John, 46 Whitney Ave., Elmhurst, L. I., N. Y.  
 Berry, A. O., 451 Oak St., Chattanooga, Tenn.  
 Bertsch, John C., 1464 North Main St., Tulsa, Okla.  
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 Conard, W. R., Burlington, N. J.  
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 Lawrence, Schuyler, Rm. 153, War Trade Bldg., Washington, D. C.  
 Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.  
 Norris, R. V., 524 2nd Natl. Bank, Wilkes-Barre, Pa.  
 Robbins, Percy A., Timmins, Ontario, Canada.

**MINING PLANTS**

Behr, H. C., 2 Rector St., New York.  
 Hatfield, Robert L., 207 Market St., Newark, N. J.

**MOTOR TRUCKS**

Myers, Cornelius T., Box 25, Avenel, N. J.  
 Whitte, Captain, 219 W. 81st St., New York.

**MUNICIPAL**

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

**N****NATURAL GAS**

Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Hope Engineering & Supply Co., Mt. Vernon, Ohio.

**NATURAL GAS PLANTS**

Peterson & Co., Frank P., 535 N. Cheyenne St., Tulsa, Okla.

**NAVAL** (See also Marine)

Hardesty, Frederick S., Commercial Natl. Bank Bldg., Washington, D. C.  
 Norden, Carl L., 375 Fulton St., Room 50, New York.

O

**OIL/FUEL**

Cary, Albert A., 95 Liberty St., New York.

**OIL REFINERIES**

Bertsch, John C., 1164 North Main St., Tulsa, Okla.

Fink, J. B., P. O. Box 578, Tulsa, Okla.

Peterson & Co., Frank P., 535 N. Cheyenne St., Tulsa, Okla.

Williams, W. G., Oklahoma City, Okla.

**OPTICAL GLASS MANUFACTURE**

Davis, Charles Ethan, 885 West End Ave., New York.

**ORDNANCE**

Kaighn, Herbert E., 2600 Harrison St., Wilmington, Del.

**ORE DRESSING**

Hatfield, Robert L., 207 Market St., Newark, N. J.

Hiller, Joseph L., 21 S. 12th St., Philadelphia, Pa.

**ORGANIZATION** (See also Factories)

Baher, Wm. H., 120 Broadway, New York.

Bartlett, D. Dana, 44 W. 44th St., New York.

Brown, Holcombe J., Box 101, Ridley Park, Pennsylvania.

Calder, John, 25 Merriam St., Lexington, Mass.

Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.

Cooley-Marvin Co., 711 Termonst Bldg., Boston, Mass.

Fitch, Claude E., 38 So. Dearborn St., Chicago, Ill.

Hannah, Frederick A., 32 W. 40th St., New York.

Kaighn, Herbert E., 2600 Harrison St., Wilmington, Del.

Kidder, Walter M., 143 W. 82nd St., New York.

McDonald, Albert, 6 E. 39th St., New York.

Mahoney, J. N., 615-77th St., Brooklyn, N. Y.

Rautenstrauch, Walter, Columbia University, New York.

Slocum, Avram & Slocum Laboratories, Inc., Woolworth Bldg., New York.

**OXY-ACETYLENE**

Cave, Henry, 290 Collins St., Hartford, Conn.

P

**PAPER MILLS**

Baxter, Burke M., 711 Union Bldg., Cleveland, Ohio.

Carey, James L., 208 N. Laramie Ave., Chicago, Ill.

Eaton, C. E., Watertown, New York.

**—Ventilation**

Briner, E. A., 370 Central Ave., E. Orange, N. J.

**PATENT EXPERTS**

Bierbaum, Christopher H., 1011 Mutual Life Building, Buffalo, N. Y.

Cary, Albert A., 95 Liberty St., New York.

Harris, Ford W., 933 Higgins Bldg., Los Angeles, Calif.

Johnson, Nathan C., 149 Broadway, New York.

Penney, H. D., 9 Murray St., New York.

Scrivenor, Arthur, 714 Mutual Bldg., Richmond, Va.

Sessions, Frank L., Rockefeller Building, Cleveland, Ohio.

**PATENT LAWYERS**

Alexander & Dowell, 900 F St., Washington, D. C.

Barkelaw, James T., 911 Central Bldg., Los Angeles, Calif.

Greenwood, T. T., 40 Court St., Boston, Mass.

Hammer, Edwin W., 160 Broadway, New York.

Harris, Ford W., 933 Higgins Bldg., Los Angeles, Calif.

Lockwood, Marquis H., 2 Rector St., New York.

Marshall, E. W., 160 Broadway, New York.

Penney, Harold D., 9 Murray St., New York.

Ramsey, George, 47th Floor, Woolworth Bldg., New York.

Roberts, Odin, 95 Milk St., Boston, Mass.

Schoenborn, William E., McGill Bldg., Washington, D. C.

Slocum, Avram & Slocum Laboratories, Inc., Woolworth Bldg., New York.

Schuetz, F. F., 50 Church St., New York.

Varney, William W., 1229 Calvert Building, Baltimore, Md.

Wagner, Frank C., Rose Polytechnic Inst., Terre Haute, Ind.

Whitman, Ray B., 505 Fifth Ave., New York.

Williams, W. G., Oklahoma City, Okla.

**PETROLEUM**

Beatie, Cecil E., 31 Union Square, West, New York.

Hope Engineering & Supply Co., Mt. Vernon, Ohio.

Peterson & Co., Frank P., 535 N. Cheyenne St., Tulsa, Okla.

**PETROLEUM DISTILLING EQUIPMENT**

Williams, W. G., Oklahoma City, Okla.

**PIPE MILLS**

Ellis, Frank I., 2126 Farmers Bnk. Bldg., Pittsburgh, Pa.

**PLANTS** (See also Cement, Coal Handling, Coke, Filtration, Flour Milling, Foundry, Gasoline, Gypsum, Industrial, Mining, Natural Gas, Potash, Power, Pumping, Steam)

**POTASH PLANTS**

Cannon-Swenson Co., 940 Monadnock Bldg., Chicago, Ill.

Meade & Co., Richard K., 11 E. Fayette St., Baltimore, Md.

**POWDERED COAL**

American Industrial Engrg. Co., Monadnock Block, Chicago, Ill.

Cary, Albert A., 95 Liberty St., New York.

**POWER**

Almert, Harold, 209 S. La Salle St., Chicago, Ill.

Thomas, Percy H., 120 Broadway, New York.

**—Generation**

Bierbaum, Christopher H., 1011 Mutual Life Building, Buffalo, N. Y.

Case, Willard L., 17 Battery Pl., New York.

Dalley, A. H., Charles, 801-22 S. Michigan Ave., Chicago, Ill.

Dreyfus, Edwin D., 1102 Benedum-Trees Bldg., Pittsburgh, Pa.

Fitch, Claude E., 38 So. Dearborn St., Chicago, Ill.

Garland, C. M., 1049 Ardmore Ave., Chicago, Ill.

Gebhardt, G. F., Armour Inst. of Tech., Chicago, Ill.

Lucke, Charles E., Columbia University, New York.

Marks, Lionel S., Harvard University, Cambridge, Mass.

Railway & Industrial Engrs., Inc., 25 Broad St., New York.

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

Safford, Arthur T., 66 Broadway, Lowell, Mass.

Swartwout, Everett W., 20 Lafayette St., White Plains, New York.

Wood, Albert C., Stock Exchange Bldg., Philadelphia, Pa.

**—Transmission**

Case, Willard L., 17 Battery Pl., New York.

White Engineering Corp., J. G., 43 Exchange Place, New York.

**POWER PLANTS**

Azbe, Victor J., 2104 Railway Exchange Bldg., St. Louis, Mo.

Boomhower, F. K., 216 Burlingame, Detroit, Mich.  
 Breslove, Jos., Oliver Bldg., Pittsburgh, Pa.  
 Buckley, John H., Box 335, Yonkers, N. Y.  
 Cundall, Robert N., Cundall, Powell & Mosher, Inc., 80 W. Genesee St., Buffalo, N. Y.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Engel Sr. Construction Co., Godfrey, 17 Battery Pl., New York.  
 Freyn, Bassett & Co., 122 S. Michigan Ave., Chicago, Ill.  
 Haven, H. M. & Crosby, Wm. H., 40 Court St., Boston, Mass.  
 Hollis French, & Allen Hubbard, 88 Pearl St., Boston, Mass.  
 Hopkins, M. S., 1106 Hayden Bldg., Columbus, O.  
 Hurd, Charles H., 1405 Merchants Bank Bldg., Indianapolis, Ind.  
 Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.  
 Magruder, Wm. T., Ohio State University, Columbus, O.  
 Neale, William McC., P. O. Box 351, Greensboro, North Carolina.  
 Posey, James, 1107 Fidelity Bldg., Baltimore, Md.  
 Prather, H. B., 664 Rockefeller Bldg., Cleveland, O.  
 Rippey, S. Howard, 7012 Greene St., Philadelphia, Pa.  
 Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.  
 Sherman, Walter P., 1407 Singer Bldg., (149 Broadway), New York.  
 Stevens, John A., 8 Merrimack St., Lowell, Mass.  
 Taggart, James M., 1328 Broadway, New York.  
 Taylor, Percy B., Essex Bldg., Newark, N. J.  
 Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.  
 Vaughn, John F., 185 Devonshire St., Boston, Mass.  
 White Engineering Corp., J. G., 43 Exchange Place, New York.  
 Whiting, Charles W., 148 State St., Boston, Mass.  
**—Cost Accounting**  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
**—Designing**  
 Acheson, A. R., 852 Ostrom Ave., Syracuse, N. Y.  
 Adler, Alphonse A., 85 Livingston St., Brooklyn, N. Y.  
 Ballinger & Perrot, N. W. Cor. 17th and Arch Sts., Philadelphia, Pa.  
 Brown & Co., Edward C., 220 Devonshire St., Boston, Mass.  
 Carey, Albert A., 95 Liberty St., New York.  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Fuel Engrg. Co. of N. Y., 106 E. 19th St., New York.  
 MacLeod, Norman M., 39 W. Loudon St., Germantown, Philadelphia, Pa.  
 McHollan, James A., 55 Liberty St., New York.  
 Misostown, Henry, 536 Rush St., Chicago, Ill.  
 Norton, Fred E., 656 Main St., Worcester, Mass.  
 Scrivenor, Arthur, 714 Mutual Bldg., Richmond, Va.  
**—Hydroelectric**  
 Ferguson, H. S., 200 Fifth Ave., New York.  
 Finkle, Frederick Cecil, 448-449 I. W. Hellman Bldg., Los Angeles, Cal.  
 Holland, Ackerman & Holland, Lawrence Bldg., Ann Arbor, Mich.  
 Hutchinson, Cary T., 65 W. 54th St., New York.  
 Larner, Chester W., Widener Bldg., Philadelphia, Pa.  
 Main, Charles T., 210 Devonshire St., Boston, Mass.  
**—Labor Organisation**  
 Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.

**—Management**

McHollan, James A., 55 Liberty St., New York.  
 Polakov, Walter N., 31 Nassau St., New York.

**—Operation**

Collins, Hubert E., 132 Boyce Ave., Utica, N. Y.  
 Fuel Engrg. Co. of N. Y., 106 E. 19th St., New York.

**—Piping**

English Co., William T., 308-10 Dover St., Boston, Mass.

**—Steam-Electric**

Taylor & Downes, 301 Gaston Bldg., Dallas, Tex.

**PRESSES, HYDRAULIC**

Carver, Fred S., 8 West 40th St., New York.

**PRODUCTION (See also Efficiency)**

Ayres, R. S., 10 Wellman St., Brookline, Mass.  
 Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.  
 Dollar, W. M., Buffalo, N. Y.  
 Kidder, Walter M., 143 W. 82nd St., New York.  
 Lane Co., H. M., 701 Owen Bldg., Detroit, Mich.  
 McDonald, Albert, 6 E. 39th St., New York.  
 Scovell, Wellington & Co., 110 State St., Boston, Mass.  
 Scrivenor, Arthur, 714 Mutual Bldg., Richmond, Va.  
 Shepard, George H., Navy Yard, Norfolk, Va.

**PROJECTILE PRODUCING EQUIPMENT**

Bryant, Geo. F., 1025 S. Menard Ave., Chicago, Ill.

**PUBLIC UTILITIES (See also Investigations, Valuation)**

Almert, Harold, 209 S. La Salle St., Chicago, Ill.  
 Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.  
 Stone & Webster, 147 Milk St., Boston, Mass.  
 Vaughan, John F., 185 Devonshire St., Boston, Mass.  
 White Engineering Corp., J. G., 43 Exchange Place, New York.  
 Whiting, Charles W., 148 State St., Boston, Mass.

**—Management**

Day & Zimmermann, Inc., 611 Chestnut St., Philadelphia, Pa.  
 Offut, M. Webb, Georgetown, Kentucky.  
 Stone & Webster, 147 Milk St., Boston, Mass.

**—Operation**

Collins, Francis W., 50 Church St., New York.

**—Regulation**

Hoxie, Geo. L., 50 East 41st St., New York.

**PUBLICITY (See also Advertising)**

De Wolfe, E. C., 608 So. Dearborn St., Chicago, Ill.  
 Michel & Staff, A. Eugene, 116 Nassau St., New York.  
 Whipple, George Francis, Allston Square, Boston, Mass.

**PULP MILLS**

Cannon-Swenson Co., 940 Monadnock Bldg., Chicago, Ill.  
 Ryther, Geo. D., Carthage, N. Y.

**PUMPING PLANTS**

Sherman, Walter P., 1407 Singer Bldg., (149 Broadway), New York.

**PURCHASING**

Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.

**R****RAILROAD STATIONS**

Place, Clyde R., Grand Central Terminal, New York.

**RAILWAY EQUIPMENT**

Railway & Industrial Engineers, Inc., 25 Broad St., New York.

**REFRACTORY MATERIALS**

Pike, Robert D., 74 New Montgomery St., San Francisco, Cal.

**REFRIGERATION**

Fletcher, E. L., 1089 Broad St., Fletcher-Thompson, Inc., Bridgeport, Conn.

Goetz, Victor J., 675 N. 12th St., Philadelphia, Pa.

Haven, H. M., & Crosby, Wm. W., 40 Court St., Boston, Mass.

McKee, Thomas C., 431 S. Dearborn St., Chicago, Ill.

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

Roelker, H. B., 41 Madison Ave., New York.

Schloss, Newton L., 531 W. 143rd St., New York.

Voorhees, Gardner T., Engineers Club, New York.

**—Fish**

Irwin, Oliver C., 291 Broadway, New York.

**—Marine**

Irwin, Oliver C., 291 Broadway, New York.

**REINFORCED CONCRETE**

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

**RESEARCH** (See also Field)

Abbott, Jr., W. G., Wilton, N. H.

Greenwood, T. T., 40 Court St., Boston, Mass.

Hopkins, Nevil Monroe, 2128 Bancroft Pl., Washington, D. C.

Winestock, Otto C., Perkinville, Vt.

**RIVER & HARBOR IMPROVEMENTS**

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

Birby, William H., Rm. 700 Army Bldg., 230 East Ohio Bldg., Chicago, Ill.

**ROLLING MILLS**

Ellis, Frank I., 2126 Farmers' Bnk. Bldg., Pittsburgh, Pa.

**RUBBER**

Hutchens, Edward, 703 Wisconsin St., Eau Claire, Wisconsin.

**RUSTPROOFING**

Wunsch & Washburn, 487 Broadway, New York.

**S**

**SAFETY**

Bagg, S. F., 251 River St., Troy, New York.

Banash, J. I., 30 E. 42nd St., New York.

Kaighn, Herbert E., 2600 Harrison St., Wilmington, Del.

Spence, Peter C., 70 W. 71st St., New York.

**SALT WORKS**

Cannon-Swenson Co., 940 Monadnock Bldg., Chicago, Ill.

**SANITARY**

Ballinger & Perrot, N. W. Cor. 17th and Arch Sts., Philadelphia, Pa.

Gerhard, Dr. Wm. Paul, 736 W. 181st St., New York.

Hering, Rudolph, 170 Broadway, New York.

Hurd, Charles H., 1405 Merchants' Bank Bldg., Indianapolis, Ind.

Landreth, Olin H., 156 5th Ave., New York.

Sutton, Frank, 80 Broadway, New York.

**SEWAGE DISPOSAL**

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.

**SEWERS**

Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.

**SHOP MANAGEMENT**

Dollar, M., Buffalo, N. Y.

Harris, Harry E., P. O. Box 852, Bridgeport, Conn.

**SPRINKLER**

Hoagland, Ira G., 80 Maiden Lane, New York.

**SPRINKLER EQUIPMENT**

English Co., William T., 308-10 Dover St., Boston, Mass.

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

**STANDARDIZATION**

Buckley, John H., Box 335, Yonkers, N. Y.

**STATISTICS**

Polakov, Walter N., 31 Nassau St., New York.

**STEAM HAMMERS**

Bell, David, 1555 Fillmore Ave., Buffalo, N. Y.

**STEAM PLANTS** (See also Testing)

Almert, Harold, 209 S. La Salle St., Chicago, Ill.

Baxter, Burke M., 711 Union Bldg., Cleveland, Ohio.

Bryan, Marcus K., Medford Bldg., Akron, Ohio.

Cary, Albert A., 95 Liberty St., New York.

English Co., William T., 208-10 Dover St., Boston, Mass.

Fermier, E. J., College Station, Texas.

Main, Charles T., 201 Devonshire St., Boston, Mass.

Perkins, George H., 77 Mansur St., Lowell, Mass.

Sherman, Walter P., 1407 Singer Bldg. (149 Broadway), New York.

Stevens, John A., 8 Merrimack St., Lowell, Mass.

Vaughan, John F., 185 Devonshire St., Boston, Mass.

**STEEL MILLS**

Moore & Co., W. E., 706 Union Bank Bldg., Pittsburgh, Pa.

**STORAGE BINS** (Concrete)

Deverell, Spencer & Co., Inc., 514-517 Garrett Bldg., Baltimore, Md.

**STOREKEEPING**

Cartmell, N. Madison, U. S. N. R. F., U. S. Navy Steam Engineering Sch., Stevens Inst., Hoboken, N. J.

**STRUCTURAL**

Curry, John R., 608 City Trust Bldg., Indianapolis, Ind.

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

Swain, Geo. F., Harvard University, Cambridge, Mass.

Westcott & Mapes, 207 Orange St., New Haven, Conn.

**—Designing**

Cooley-Marvin Co., 711 Tremont Bldg., Boston, Mass.

Hollis French, & Allen Hubbard, 88 Pearl St., Boston, Mass.

**SUGAR FACTORIES**

Cannon-Swenson Co., 940 Monadnock Bldg., Chicago, Ill.

Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

Saldana, Edwardo E., P. O. Box 906, San Juan, Porto Rico.

Vickess, Samuel, 129 Front St., New York.

**—Beet**

Engel Sr. Construction Co., Godfrey, 17 Battery Pl., New York.

Honolulu Iron Works Co., Woolworth Bldg., New York.

**—Cane**

Engel Sr. Construction Co., Godfrey, 17 Battery Pl., New York.

Honolulu Iron Works Co., Woolworth Bldg., New York.

Kent, R. S., R. S. Kent, Inc., 50 Court St., Brooklyn, N. Y.

**SUGAR MACHINERY**

Honolulu Iron Works Co., Woolworth Bldg., New York.

**SUPERVISION**

Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

**T****TESTING****—Gas**

Fink, J. B., P. O. Box 578, Tulsa, Okla.

**—Hydraulic Turbine**

Allen, Charles M., Worcester Polytechnic Inst., Worcester, Mass.

**—Laboratory**

Electrical Testing Laboratories, 80th St. & East End Ave., New York.

Gebhardt, G. F., Armour Inst. of Tech., Chicago, Ill.

Le Page, C. B., Stevens Inst. of Tech., Hoboken, N. J.

**—Materials**

Conard, W. R., Burlington, N. J.  
Fermier, E. J., College Station, Texas.

**—Steam Plants**

Cary, Albert A., 95 Liberty St., New York  
Gebhardt, G. F., Armour Inst. of Tech., Chicago, Ill.

**TEXTILE MILLS**

Hartshorne, Wm. D., 40 Pleasant St., Methuen, Mass.

Perkins, George H., Lowell, Mass.

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

**TIME FUSE MANUFACTURE**

Davis, Charles Ethan, 885 West End Ave., New York.

**TOOL DESIGNING**

Bentley & Holmgren, 406 Court Exchange Bldg., Bridgeport, Conn.

Diamant, Sidney, 164 Emmett St., Newark, N. J.

Harris, Harry E., P. O. Box 852, Bridgeport, Conn.

**TRACTORS**

Myers, Cornelius T., Box 25, Avenel, N. J.

**TRAMWAYS****—Wire Rope**

Newell, Wallace L., 1017 Alaska Building, Seattle, Washington.

**TRANSPORTATION**

Swain, Geo. F., Harvard University, Cambridge, Mass.

**V****VALUATION** (See also Appraisals)

Almert, Harold, 209 S. La Salle St., Chicago, Ill.

Cooley-Marvin Co., 711 Tremont Bldg., Boston, Mass.

Harris, Harry E., P. O. Box 852, Bridgeport, Conn.

Hoxie, Geo. L., 50 East 41st St., New York.

Landreth, Olin H., 156 5th Ave., New York.

Scott, Arthur C., 1816 $\frac{1}{2}$  Main St., Dallas, Texas.

Swain, Geo. F., Harvard University, Cambridge, Mass.

**—Industrial Plants**

Case, Willard L., 17 Battery Pl., New York.

Richmond, Knight C., 10 Weybosset St., Providence, R. I.

**—Public Utilities**

Collins, Francis W., 50 Church St., New York.

**VENTILATING** (See also Heating and Ventilating)

Boomhower, F. K., 216 Burlingame, Detroit, Mich.

Goubert, Aug. A., 90 West St., New York.

Landvoigt, Thomas E., 1007 Monroe St., N. W., Washington, D. C.

Spence, Peter C., 70 W. 71st St., New York.

Toltz, King and Day, Inc., 1410 Pioneer Building, St. Paul, Minn.

**W****WASTE HEAT**

American Industrial Engrg. Co., Monadnock Block, Chicago, Ill.

**WATER SUPPLY**

Hurd, Charles H., 1405 Merchants' Bank Bldg., Indianapolis, Ind.

**WATER SUPPLY SYSTEMS**

Rice, Cyrus Wm., 63rd & Woodland Ave., Philadelphia, Pa.

Wood, Albert C., Stock Exchange Bldg., Philadelphia, Pa.

**WATER WORKS**

Salisbury, Royal D., 1415 E. Colfax, Denver, Colo.

**WELDING**

Holland, Ackerman & Holland, Lawrence Bldg., Ann Arbor, Mich.

Posey, James, 1107 Fidelity Bldg., Baltimore, Md.

**—Electric**

Adams, C. A., Harvard University, Cambridge, Mass.

**—Electric and Oxy-Acetylene**

Sessions, Frank L., Rockefeller Building, Cleveland, Ohio.

**WIRE MILLS**

American Industrial Engrg. Co., Monadnock Block, Chicago, Ill.

**WOODWORKING MACHINERY**

Neale, William McC., P. O. Box 351, Greensboro, North Carolina.

**WORK ROUTING**

Harris, Harry E., P. O. Box 852, Bridgeport, Conn.





**DIRECTORY SECTION  
PART II**

**Mechanical Equipment  
Directory**

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**Pages 785-976**

**I**N this, its fourth issue as a reference feature of the volume of Condensed Catalogues, the general Mechanical Equipment Directory shows a further gain in scope and comprehensiveness.

Wherever the omission of appropriate subject headings has been noted in this office, or called to the attention of the Society by members or others, these have been added. At the same time every effort has been made to secure and include the names of the greatest possible number of eligible manufacturers, with the result that in this volume the Directory contains the names and addresses of more than 4000 firms, listed under upward of 2800 classifications of equipment.

Owing to the considerable extra cost of compiling and publishing the Directory, it was found necessary, as in the previous issues, to limit the free listings for non-space users to three subject headings for each firm, additional listings being procurable at the rate of three dollars each. Firms using space for publication of their data in the Catalogue Section of the volume are entitled to full listing of their products in the Directory without additional charge, with the firm name printed in capital type and followed by the page numbers of their catalogue data.

The Mechanical Equipment Directory is especially designed to meet the ready-reference needs of mechanical engineers and others requiring a highly specialized list of this description. It is believed that the Directory will prove invaluable for this purpose, and also as a guide to and background for the more detailed information presented in the Catalogue Section of the volume.

**NOTE:** Trade names are given in parenthesis after the firm name under each classification.

# MECHANICAL EQUIPMENT DIRECTORY

## A

### ABRASIVE MATERIALS

Abrasive Co., Bridesburg, Philadelphia, Pa.  
 Carborundum Co., Niagara Falls, N. Y.  
 Dessau, S. Maurice, 6 Maiden Lane, New York  
 General Abrasive Co., Niagara Falls, N. Y.  
 Hampden Corundum Wheel Co., Springfield, Mass.  
 MAXF GRINDING WHEEL CORP'N, Chester, Mass...*p. 515*  
 NORTON CO., Worcester, Mass...*p. 516*  
 STERLING GRINDING WHEEL CO., Tiffin, O...*p. 517*  
 White Heat Products Co., Frazer (Chester Co.), Pa.

### ABRASIVE WHEELS

(See Grinding Wheels)

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 \*ALLIANCE MACHINE CO., Alliance, O...*p. 363*  
 BUCKEYE IRON & BRASS WORKS, Dayton, O...*p. 617*  
 BURROUGHS CO., CHARLES, Newark, N. J...*p. 610*

\*CAMDEN IRON WORKS, Camden, N. J...*p. 609*

Dunning & Boschert Press Co., Inc., 329 W. Water St., Syracuse, N. Y.

Elmes Engineering Works, Chas. F., 215 N. Morgan St., Chicago, Ill.

GALLAND-HENNING MFG. CO., 26th-27th Ave. & Layton Park, Milwaukee, Wis...*p. 611*

METALWOOD MFG. CO., Detroit, Mich...*p. 612*

NILES-BEMENT-POND CO., 111 Broadway, New York...*p. 460*

Perrin & Co., Wm. R., 37 W. Van Buren St., Chicago, Ill.

ROBERTSON & CO., JOHN, 133 Water St., Brooklyn, N. Y...*p. 613*

SOUTHWARK FOUNDRY & MACHINE CO., 400 Washington Ave., Philadelphia, Pa...*p. 614*

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WATSON-STILLMAN CO., 35 Church St., New York...*p. 615*

WOOD & CO., R. D., Philadelphia, Pa...*p. 616*

### ACETYLENE APPARATUS

Bastian-Blessing Co., W. Austin Ave. at La Salle St., Chicago, Ill.  
 Carbic Mfg. Co., Duluth, Minn.  
 Davis-Bournonville Co., Jersey City, N. J.  
 K-G WELDING & CUTTING CO., INC., 556 W. 34th St., New York...*p. 564*  
 \*INTERNATIONAL OXYGEN CO., 796 Frelinghuysen Ave., Newark, N. J...*p. 567*  
 Modern Engineering Co., 23rd & Walnut Sts., St. Louis, Mo.

### ACETYLENE GAS

Air Reduction Co., Inc., 120 Broadway, New York  
 K-G WELDING & CUTTING CO., INC., 556 W. 34th St., New York...*p. 564*

### ACETYLENE LIGHTS (Portable)

MILBURN CO., ALEXANDER, 1420-26 W. Baltimore St., Baltimore, Md...*p. 565*

### AERIAL TRAMWAYS

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### AGITATORS

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Lamprey Co., 285 Elm St., Westfield, Mass.

**ASBESTOS PRODUCTS**

Acme Asbestos Covering & Supply Co., 407 N. Ada St., Chicago, Ill.

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Thermoid Rubber Co., Trenton, N. J.

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Fairbanks Co., 416-422 Broome St., New York

Fisher Machine Co., 310-316 N. 11th St., Philadelphia, Pa.

Gear Grinding Machine Co., Detroit, Mich.

Grant-Lees Gear Co., 2367 E. 69th St., Cleveland, O.

Humason Mfg. Co., Forestville, Conn.

Micro Piston Ring Co., 110-116 Nassau St., New York

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 Cross Gear & Engine Co., 800-806 Bellevue Ave., Detroit, Mich.  
 Johnson & Co., Inc., J. R., P. O. Box 515, Richmond, Va.  
 Liggett Spring & Axle Co., Monongahela, Pa.  
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 Union Drop Forge Co., 358 W. Grand Ave., Chicago, Ill.

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 Bridgeport Engineering Co., Bridgeport, Conn.  
 Clark Equipment Co., 1415 Railway Exchange, Buchanan, Mich.  
 Empire Axle Co., Dunkirk, N. Y.  
 Hess Spring & Axle Co., 146 W. 66th St., Carthage, Cincinnati, O.  
 Industrial Equipment Co., 70th & Garfield Ave., Oakland, Cal.  
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 Empire Metal Co., Syracuse, N. Y.  
 Frictionless Metal Co. (Frictionless), 1103 Chestnut St., Chattanooga, Tenn.  
 Jacobson & Sons Co., I. M. (Motex), 70-72 Catherine St., Detroit, Mich.  
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 Michigan Smelting & Refining Co., Detroit, Mich.  
 Murdoch & Co., H., 432 Wood St., Pittsburgh, Pa.  
 Murphy Metals Co. (Murphy), 327 S. La Salle St., Chicago, Ill.  
 National Lead Co. (Dutch Boy), 111 Broadway, New York  
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Chatillon & Sons, John, 85-93 Cliff St., New York  
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Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.

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Shear-Klean Grate Co., 810 Modadnock Bldg., Chicago, Ill.

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Lackawanna Steel Co., Buffalo, N. Y.

Youngstown Sheet & Tube Co., Youngstown, O.

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Concrete Steel Co., 42 Broadway, New York

Franklin Steel Works, Franklin, Pa.

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Falls Hollow Staybolt Co., 21 E. Portage St., Cuyahoga Falls, O.

**—Steel**

Atlantic Steel Co., Atlanta, Ga.

Cincinnati Iron & Steel Co., Cincinnati, O.

Concrete Steel Co., 42 Broadway, New York

Crowley Co., John A., 120 Liberty St., New York

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Hutchinson, Inc., Miller Reese, Orange, N. J.

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Bantam Ball Bearing Co., Bantam, Conn.

Bearings Co. of America, 1012 Ford Bldg., Detroit, Mich.

Carlson-Wenstrom Co., Erie Ave. & Richmond St., Philadelphia, Pa.

\*FAFNIR BEARING CO., New Britain, Conn...*p.* 295

Federal Bearings Co., Inc., 110 William St., Poughkeepsie, N. Y.

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Salisbury Ball Bearing Corp'n, Jamestown, N. Y.

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Ball & Roller Bearing Co., Danbury, Conn.

Bantam Ball Bearing Co., Bantam, Conn.

Bower Roller Bearing Co. (Bower), Detroit,  
Mich.

\*GWILLIAM CO., 253 W. 58th St., New York  
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American Ball Co., Providence, R. I.

American Roller Bearing Co., 600 Melwood Ave.,  
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Beltine Chemical & Mfg. Co., 401 N. Sangamon  
St., Chicago, Ill.

Black Bear Co., 138-144 Temple St., Long Is-  
land City, N. Y.

Bradford Belting Co., 202 Walnut St., Cincin-  
nati, O.

Burr Oak Belting Co., 1105-07 York St., Cin-  
cinnati, O.

Chesapeake Belting Co., 813-823 Homewood  
Ave., Baltimore, Md.

Cling Surface Co., 1048 Niagara St., Buffalo,  
N. Y.

DURYEA MFG. CO. (Wooster), Bayonne, N.  
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GRATON & KNIGHT MFG. CO., Worcester,  
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Gripwell Pulley Covering Co., 157 Cedar St.,  
New York

Jobbers Mfg. Co. (Blue-Ribbon), 327 S. La Salle  
St., Chicago, Ill.

Kruger & Blind Co., 513 Master St., Philadel-  
phia, Pa.

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Laurence Belting Co., Inc., 111 Chambers St.,  
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cago, Ill.

Mount Vernon Belting Co., 327-333 Warren  
Ave., Baltimore, Md.

O'Brien-Northrop Oil & Chem. Co., St. Louis,  
Mo.

Palmer & Co., N., Bridgeport, Conn.

Ranville Co., F., 241-243 Pearl St., Grand Rap-  
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Reed, P. Duecker, Memphis, Tenn.

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\*FLEXIBLE STEEL LACING CO., Dept. 600,  
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**BELT LACING**

Crescent Belt Fastener Co., 381 Fourth Ave.,  
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Bonner & Barnwell, Inc., 30 Church St., New  
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Dick Co., Inc., R. & J. (Dickbelt), Passaic, N. J.  
Manheim Mfg. & Belting Co., Manheim, Pa.  
Victor Balata & Textile Belting Co., 38 Murray  
St., New York

**—Canvas**

Acme Belting Co., Niles, Mich.  
Burrell Belting Co., 413-417 S. Hermitage Ave.,  
Chicago, Ill.  
Chesapeake Belting Co., 813-23 Homewood Ave.,  
Baltimore, Md.  
DURVEA MFG. CO. (Wooster), Bayonne, N.  
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neapolis, Minn.

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Chesapeake Belting Co., 813-823 Homewood  
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Hetttrick Mfg. Co., Toledo, O.  
IMPERIAL BELTING CO. (Ibeco), Lincoln  
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Main Belting Co., 917 South 13th St., Philadel-  
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Manheim Mfg. & Belting Co., Manheim, Pa.  
Mount Vernon Belting Co., 327-333 Warren  
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National Leather Belting Co., 342 E. 38th St.,  
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ROSSENDALE-REDDAWAY BELTING &  
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Ruboil Belting Co., 8th & Wallace Sts., Phila-  
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Victor Balata & Textile Belting Co., 38 Murray  
St., New York

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**—Conveyor**

Boston Belting Co., 84 Linden Park St., Boston,  
Mass.  
Burrell Belting Co., 413-417 S. Hermitage Ave.,  
Chicago, Ill.  
Dick Co., Inc., R. & J. (Dickbelt), Passaic, N. J.  
DURVEA MFG. CO. (Wooster), Bayonne, N.  
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Scandinavia Belting Co., 106-108 Reade St.,  
New York  
Stanley Belting Corp'n, 40 S. Clinton St., Chi-  
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 Bonner & Barnwell, Inc., 30 Church St., New York  
 Empire Mfg. Co., 97 Spring St., Lockport, N. Y.  
 Gilmer Co., L. H., Philadelphia, Pa.  
 Hettrick Mfg. Co., Toledo, O.  
 McIlroy Belting & Hose Co., Hammond, Ind.  
 Nott Co., W. S., 201-211 N. Third St., Minneapolis, Minn.  
 ROSSENDALE-REDDAWAY BELTING & HOSE CO., Newark, N. J., *p.* 323  
 Scandinavia Belting Co., 106-108 Reade St., New York  
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Sumner Belting Co., Wm., Tolland, Conn.

## —Elevator

Dick Co., Inc. R. & J. (Dickbelt), Passaic, N. J.  
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 Walls Tool & Supply Co., T. P. (Marathon), 75-77 Walker St., New York

## —Fabric

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 Mount Vernon Belting Co., 327-333 Warren Ave., Baltimore, Md.  
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 Alexander Bros., 414 N. Third St., Philadelphia, Pa.  
 American Belting & Tanning Co., 135 Oliver St., Boston, Mass.  
 Barnes Co., Henry K., 234 Devonshire St., Boston, Mass.  
 Bay State Belting Co., 605 Atlantic Ave., Boston, Mass.  
 Bickford & Francis Belting Co., Buffalo, N. Y.  
 Bond Co., Charles, 520 Arch St., Philadelphia, Pa.  
 Bonner & Barnwell, Inc., 30 Church St., New York  
 Bradford Belting Co., 202 Walnut St., Cincinnati, O.  
 Burr Oak Belting Co., 1005-07 York St., Cincinnati, O.  
 California Belting Co., Inc., 1459-61-63 Mission St., San Francisco, Cal.  
 Central Belting Co., 151 Lafayette St., New York

Chicago Belting Co., 113 N. Green St., Chicago, Ill.

Coe & Brown Co., New Haven, Conn.  
 Consolidated Belting Co., 2 Jeffrey St., Chester, Pa.

Cook Belting Co., H. N., 401 Howard St., San Francisco, Cal.

Couse & Bolton, 42 Lafayette St., Newark, N. J.  
 Covell Belting Co., 41 N. 7th St., Philadelphia, Pa.

Cowan & Co., Andrew, Louisville, Ky.  
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Ease Counter & Leather Co., 414 E. 8th St., Cincinnati, O.

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 Houghton & Co., E. F. (Vim), 3rd, American & Somerset Sts., Philadelphia, Pa.

Hudson Belting Co., Worcester, Mass.

Ireson, Charles L., 221 High St., Boston, Mass.

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Missouri Belting Co., 1021-29 S. Grand Ave., St. Louis, Mo.

Moloney Belting Co., 130 N. Franklin St., Chicago, Ill.

Mooney Belting Co., Cincinnati, O.

National Leather Belting Co., 342 E. 38th St., New York

New York Leather Belting Co., 465 Kent Ave., Brooklyn, N. Y.

Norwich Belting Co., Norwich, Conn.

Nott Co., W. S., 201-211 N. Third St., Minneapolis, Minn.

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Page Belting Co., Concord, N. H.

Palmer & Co., N. (Charter Oak), Bridgeport, Conn.

Paulus & Co., Jos C., 2507-11 Potter St., Philadelphia, Pa.

Philadelphia Belting Co., Sixth & Spring Garden Sts., Philadelphia, Pa.

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Strong & Hery Co., 301-307 State St., Rochester,  
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Turner Mfg. Co., J. S., 133 Middle St., Lowell,  
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Ulmer Leather Co., Norwich, Conn.

Union Belt Co., Fall River, Mass.

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Chicago Rawhide Co., 1301 Elston Ave., Chi-  
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**—Rubber**

Anchor Packing Co., 7th & Filbert Sts., Phila-  
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Belmont Packing & Rubber Co., 133 N. Second  
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Boston Belting Co., 84 Linden Park St., Boston,  
Mass.

Boston Woven Hose & Rubber Co., Cambridge,  
Mass.

Bowers Rubber Works, 68 Sacramento St., San  
Francisco, Cal.

Cincinnati Rubber Mfg. Co., Cincinnati, O.

Consumers Rubber Co., 829 Superior Ave.,  
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Burr Oak Belting Co., 1105-07 York St., Cin-  
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Central Belting Co., 151 Lafayette St., New York

Chicago Rawhide Mfg. Co., 1301 Elston Ave.,  
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Cook Belting Co., H. N., 401 Howard St., San  
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Mooney Belting Co., Cincinnati, O.

Olmsted-Flint Co., Cambridge, Mass.

Paulus & Co., Jos. C., 2507-11 Potter St., Phila-  
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Peerless Belting Co., Gardenville Station, Buf-  
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 Ajax Mfg. Co., 3830 Lakeside Ave., Cleveland, O.  
 Brown Co., H. B., East Hampton, Conn.  
 Kent Machine Co., Kent, O.  
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Clark Bros. Bolt Co., Milldale, Conn.  
The Cleveland Wrought Products Co., Cleveland, Ohio  
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Lamson & Sessions Co., Cleveland, O.  
Michigan Bolt & Nut Works, Detroit, Mich.  
National Screw & Tack Co., 7413 Stanton Ave., Cleveland, O.  
Pittsburgh Screw & Bolt Co., Preble Ave., Pittsburgh, Pa.  
Standard Bolt Co., Columbus, O.  
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Brohard Co., 3rd St. & Lehigh Ave., Philadelphia, Pa.  
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Hall's Sons, Samuel, 229 W. 10th St., New York  
Ohio Nut & Bolt Co., Berea, O.  
Oliver Iron & Steel Co., Pittsburgh, Pa.  
Rhode Island Tool Co., 148 West River St., Providence, R. I.

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# **—Spring**

Bowen Products Corp'n, Auburn, N. Y.  
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Steward & Romaine Mfg. Co., 124 No. 6th St., Philadelphia, Pa.

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Star Expansion Bolt Co., 147-149 Cedar St., New York

Steward & Romaine Mfg. Co., 124 N. 6th St., Philadelphia, Pa.

# **—Track**

National Bolt & Nut Co., 62nd St. & A. V. R. R., Pittsburgh, Pa.

**BOOK-BINDERS' MACHINERY**

Sigourney Tool Co., 9 Sigourney St., Hartford, Conn.

\*SOUTHWORTH MACHINE CO., Portland, Maine... *p. 441*

**BOOSTERS, GAS**

HOPE ENGINEERING & SUPPLY CO., Mt. Vernon, O... *p. 36*

INGERSOLL-RAND CO., 11 Broadway, New York... *pp. 572, 753*

Roots Co., P. H. & F. M., Connerville, Ind.

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Defiance Machine Works, Defiance, O.

Gisholt Machine Co., Madison, Wis.

Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.

Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

NILES-BEMENT-POND CO., 111 Broadway, New York... *p. 460*

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Pedrick Tool & Machine Co., 2643 N. Lawrence St., Philadelphia, Pa.

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Bennett, Howard D., 2114 Allendale St., Baltimore, Md.

Betts Machine Co., Rochester, N. Y.

Bickford & Co., H., Lakeport, N. H.

BULLARD MACHINE TOOL CO., Bridgeport, Conn... *pp. 452, 453, 454*

CINCINNATI PLANNER CO., Oakley, Cincinnati, O... *pp. 456, 457*

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Gisholt Machine Co., Madison, Wis.

King Machine Tool Co., Winton Place Station, Cincinnati, O.

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**BORING, DRILLING AND MILLING MACHINES (Horizontal Combined)**

Cleveland Machine Tool Co., 3215 Superior Ave., Cleveland, O.

Espen-Lucas Machine Works, Front St. & Girard Ave., Philadelphia, Pa.

GIDDINGS & LEWIS MFG. CO., Fond du Lac, Wis... *p. 342*

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Beaman & Smith Co., Providence, R. I.

Defiance Machine Works, Defiance, O.

Hartford Engine Works, 223 State St., Hartford, Conn.

Moline Tool Co., Moline, Ill.

NILES-BEMENT-POND CO., 111 Broadway, New York... *p. 460*

Rooksby & Co., E. J., 435 N. Eleventh St., Philadelphia, Pa.

Stow Flexible Shaft Co., 26th & Callowhill Sts., Philadelphia, Pa.

**—Cylinder (Locomotive)**

Barrett Machine Tool Co., Meadville, Pa.

**—Horizontal**

Barrett Machine Tool Co., Meadville, Pa.

Giddings & Lewis Mfg. Co., Fond du Lac, Wis.

**—Multiple Spindle**

Barrett Machine Tool Co., Meadville, Pa.

Greenlee Bros. & Co., Rockford, Ill.

Moline Tool Co., Moline, Ill.

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Baker Brothers, Toledo, O.

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**BOTTLE MOLD CUTTING MACHINES**

KELLER MECHANICAL ENGRAVING CO., 68 Washington St., Brooklyn, N. Y... *p. 494*

**BOTTLE WASHING MACHINERY**

Loew Mfg. Co., 9100 Morison Ave., Cleveland, O.

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\*VILTER MFG. CO., 1194-1196 Clinton St., Milwaukee, Wis... *pp. 12, 13*

**BOX MAKING MACHINERY****—Paper**

Griswold Machine Co., Geo. M., New Haven, Conn.

Jagenberg Machine Co., Inc., 131 W. 24th St., New York

Knowlton Co., M. D., 29 Elizabeth St., Rochester, N. Y.

Mereen Johnson Machine Co., Minneapolis, Minn.

Robinson Co., John T., Hyde Park Sta., Boston, Mass.

Staudt Mfg. Co., E. G., 2875 University Ave., St. Paul, Minn.

Stokes & Smith Co., Summerdale, Philadelphia, Pa.

**—Wood**

Cobden Machine Works, Cobden, Ill.

Chase, Turbine Mfg. Co., Orange, Mass.

\*JONES FOUNDRY & MACHINE CO., W. A., 4401-4451 West Roosevelt Road, Chicago, Ill... *pp. 268, 269, 270, 271*

Luster-Jordan Co., Inc., W. Washington St., Norristown, Pa.

**BOXES****—Annealing and Carbonizing**

Blaw-Knox Co. (Knox), Pittsburgh, Pa.

Garwood Bronze & Iron Works, Garwood, N. J.

MALLEABLE IRON FITTINGS CO., Branford, Conn... *p. 192*

MARSHALL FOUNDRY CO., 1st Natl. Bank Bldg., Pittsburgh, Pa... *p. 670*

PETROLEUM IRON WORKS CO., Sharon, Pa... *pp. 672, 673*

**—Case Hardening**

Bell & Gossett Co., 609 W. 30th St., Chicago, Ill.

Driver-Harris Co., Harrison, N. J.

Sivyer Steel Casting Co., Milwaukee, Wis.

**—Fibre**

AMERICAN VULCANIZED FIBRE CO., Wilmington, Del... *p. 403*

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**—Fuse**

D & W FUSE CO., Providence, R. I... *p. 520*

\*GENERAL ELECTRIC CO., Schenectady, N. Y... *pp. 16-25, inc.*

**—Metal**

Advance Engineering Co., Cleveland, O.

Cleveland Wire Spring Co., Cleveland, O.

Globe Mach. & Stamping Co., 1254 W. 76th St., Cleveland, O.

Lyon Metallic Mfg. Co., Aurora, Ill.

**—Piling (Steel)**

Cleveland Wire Spring Co., Cleveland, O.

**—Tool**

Cleveland Wire Spring Co., Cleveland, O.

**—Tote**

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

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\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p.* 200  
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### BRAKE DRUMS (Pressed Steel)

WORCESTER PRESSED STEEL CO., Worcester, Mass... *p.* 414

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American Abrasive Metals Co., 50 Church St., New York, N. Y.

### BRAKES

#### —Air

\*GENERAL ELECTRIC CO., Schenectady, N. Y... *pp.* 16-25, *inc.*  
Westinghouse Air Brake Co., Wilmerding, Pa.  
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#### —Electric

Electric Controller & Mfg. Co., Cleveland, O.

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Chase Rolling Mill Co., Waterbury, Conn.  
Rutter & Co., Arthur T., 256 Broadway, New York  
Taunton-New Bedford Copper Co., Taunton, Mass.  
Winchester Repeating Arms Co., New Haven, Conn.

### BRASS GOODS

American Lubricator Co., Detroit, Mich.  
Bridgeport Brass Co., Bridgeport, Conn.  
BUCKEYE IRON & BRASS WORKS, Dayton, O... *p.* 617  
Cleveland Brass Mfg. Co., 4606 Hamilton Ave., Cleveland, O.

Commonwealth Brass Corp'n., Commonwealth Ave. & Grand Trunk Ry., Detroit, Mich.

\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp.* 138, 139, 140, 141

Grand Rapids Brass Co., 90 Scribner Ave., N. W., Grand Rapids, Mich.

\*GREENE, TWEED & CO., 109 Duane St., New York... *p.* 202

KELLY & JONES CO., Greensburg, Pa... *pp.* 150, 151

Mueller Mfg. Co., H., Decatur, Ill.

Nathan Mfg. Co., Lawrence & Amity Sts., Flushing, Long Island, N. Y.

Ohio Brass Co., Mansfield, O.

\*RICHARDSON-PHOENIX CO., 126 Reservoir Ave., Milwaukee, Wis... *pp.* 206, 207, 208, 209

Risdon Tool & Machine Co., Naugatuck, Conn.

Rutter & Co., Arthur T., 356 Broadway, New York

Scoville Mfg. Co., Waterbury, Conn.

Smith Mfg. Co., A. P., East Orange, N. J.

Sterling Specialty Co., Newcomerstown, O.

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Pickham Boiler Co., 3035 W. Jackson Blvd., Chicago, Ill.

Turl Iron & Car Co., Inc., 50 Broad St., New York

UNIFLOW BOILER CO., INC., Philadelphia, Pa... *p.* 67

\*UNITED STATES CAST IRON PIPE & FDRY. CO., Burlington, N. J... *p.* 191

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#### —Acid Proof

Harbison-Walker Refractories Co., Farmers' Bank Bldg., Pittsburgh, Pa.

#### —Arch (Locomotive)

American Arch Co., McCormick Bldg, Chicago, Ill.

#### —Blast Furnace

Ashland Fire Brick Co., Ashland, Ky.

\*CRESCENT REFRACTORIES CO., Curwensville, Clearfield County, Pa... *p.* 115

Gardner Jr. Co., James, Ebensburg, Pa.

#### —Carborundum

Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

STERLING GRINDING WHEEL CO., Tiffin, O... *p.* 517

#### —Enameled

American Enameled Brick & Tile Co., 52 Vanderbilt Ave., New York

#### —Fire

American Enameled Brick & Tile Co., 52 Vanderbilt Ave., New York

Ashland Fire Brick Co., Ashland, Ky.

Betson Plastic Fire Brick Co., Inc. (Plastic), Rome, N. Y.

\*CRESCENT REFRACTORIES CO., Curwensville, Clearfield County, Pa... *p.* 115

\*DETRICK CO., M. H., 549 W. Washington St., Chicago, Ill... *p.* 113

Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

Dover Fire Brick Co., 509 Cuyahoga Bldg., Cleveland, O.

Evans & Howard Fire Brick Co., 920 Market St., St. Louis, Mo.

Gardner Jr. Co., James (Hitemp), Ebensburg, Pa.

Harbison-Walker Refractories Co., Farmers' Bank Bldg., Pittsburgh, Pa.

\*JOINTLESS FIRE BRICK CO., 1879 Kingsbury St., Chicago, Ill... *p.* 116

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Maurer & Son, Henry, 420 E. 23rd St., New York

Pyro Clay Products Co., Oak Hill, Ohio

TAYLOR SONS CO., CHARLES, 706 Burns St., Cincinnati, Ohio... *p. 118*

Wagner Fire Brick Co., Inc., Union National Bank Bldg., Scranton, Pa.

WOODISON CO., E. J., Detroit, Mich... *p. 655*

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CELITE PRODUCTS CO., 11 Broadway, New York... *p. 114*

\*QUIGLEY FURNACE SPECIALTIES CO., Church & Cortlandt Sts., New York... *pp. 109, 117*

**—Magnesia**

Harrison-Walker Refractories Co., Farmers' Bank Building, Pittsburgh, Pa.

\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p. 200*

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\*CRESCENT REFRACTORIES CO., Curwensville, Clearfield County, Pa... *p. 115*

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**—Silica**

Gardner Jr. Co., James, Ebensburg, Pa.

Harrison-Walker Refractories Co., Farmers' Bank Bldg., Pittsburgh, Pa.

Kier Fire Brick Co., 2243 Oliver Bldg., Pittsburgh, Pa.

Mt. Union Refractories Co., Mt. Union, Pa.

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ANDERSON FOUNDRY & MACHINE

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Arnold-Creager Co., New London, O.

BARTLETT & SNOW CO., C. O., Cleveland, O... *p. 336*

BONNOT CO., Canton, O... *p. 620*

CHAMBERS BROS. CO., Philadelphia, Pa... *p. 619*

Excelsior Tool & Machine Co., East St. Louis, Mo.

Freese & Co., E. M., 180 South St., Gallion, O.

International Clay Machinery Co., 1057 Bohlander Ave., Dayton, O.

Schultz & Son, A. L., 1675 Elston St., Chicago, Ill.

\*SLOCUM, AVRAM & SLOCUM LABORATORIES, INC., 120 Pacific St., Newark, N. J... *p. 257*

Stevenson Co., Wellsville, O.

Union Engineering Co., Cuyahoga Ave. & W. 4th St., Cleveland, O.

Wellington Machine Co., Wellington, O.

**BRIDGE TRAMWAYS**

(See Tramways, Bridge)

**BRIDGES****—Movable**

American Bridge Co., 30 Church St., New York

**—Salt Handling**

Lakeside Bridge & Steel Co., 404 Villard Ave., North Milwaukee, Wis.

**—Steel**

Continental Bridge Co., Peotone, Ill.

McClintic-Marshall Co., 1217 Oliver Bldg., Pittsburgh, Pa.

Phoenix Iron Co., 22 So. 15th St., Philadelphia, Pa.

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\*ROEBLING SONS CO., JOHN A., Trenton, N. J... *p. 386*

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General Briquetting Co., 25 Broad St., New York

**—Coal**

General Briquetting Co., 25 Broad St., New York

Malcolmson, Briquet Engineering Co., Old Colony Bldg., Chicago, Ill.

Mashek Engineering Co., 90 West St., New York

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\*ALUMINUM CO. OF AMERICA, Pittsburgh, Pa... *p. 400*

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**BRONZES****—Acid Resistant**

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

Titanium Bronze Co., Inc., Niagara Falls, N. Y.

**—Aluminum**

Titanium Bronze Co., Inc., Niagara Falls, N. Y.

**—Bearing**

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\*AMERICAN BRONZE CORP'N, (Non-Gran), Berwyn, Pa... *pp. 394, 395*

BUNTING BRASS & BRONZE CO., 726 Spencer St., Toledo, O... *p. 396*

\*JOHNSON BRONZE CO., New Castle, Pa... *p. 397*

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Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

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Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

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Titanium Bronze Co., Inc., Niagara Falls, N. Y.

**—Plastic**

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

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Browning Co., Cleveland, O.

Buffalo Hoist & Derrick Co., 129 Erie St., Buffalo, N. Y.

Hais Mfg. Co., Inc., George, 141st St. & Rider Ave., New York

Hayward Co., 50 Church St., New York

Lakewood Engineering Co., Cleveland, O.

McKenna Co., 1851 E. 38th St., Cleveland, O.

Orton & Steinbrenner, 608 S. Dearborn St., Chicago, Ill.

Owen Bucket Co., 406 Rockefeller Bldg., Cleveland, O.

Smith & Sons Co., Theo., Jersey City, N. J.

Williams Co., G. H., Erie, Pa.

**—Drag Line**

Hayward Co., 50 Church St., New York

**—Electrically Operated**

Hayward Co., 50 Church St., New York

**—Elevator**

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**—Orange Peel**

Andresen-Evans Co., 646 Railway Exchange Bldg., Chicago, Ill.

Hayward Co., 50 Church St., New York

Schaeffer Machine Works, 35th & Grays Ferry Road, Philadelphia, Pa.

Smith & Sons Co., Theo., Jersey City, N. J.

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Nilson Machine Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

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 Foundry Equipment Co., Cleveland, O.  
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**HAMMEL OIL BURNING EQUIPMENT CO.**, Providence, R. I., *p. 111*  
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**\*LOCKETT & CO., LTD.**, A. M., 521-523 Baronne St., New Orleans, La., *p. 112*  
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 Metals Production Equipment Co., 105 W. 40th St., New York  
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 Monarch Mfg. Works, 3130 Emery St., Philadelphia, Pa.  
 National Supply Co., 416 W. Grand Ave., Chicago, Ill.  
 Naudain, John E., Sparrows Point, Md.  
 Parson Manufacturing Co., P. O. Box 212, Elizabeth, N. J.  
**PETROLEUM IRON WORKS CO.**, (Gem), Sharon, Pa., *p. 672, 673*  
 Reid Gas Engine Co., Joseph, Oil City, Pa.  
**\*ROCKWELL & CO.**, W. S., 50 Church St., New York, *p. 557*  
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**—Powdered Coal**  
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**—Trolley Wheel**  
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 Detroit Pulley Co., 1331 Bellevue Ave., Detroit, Mich.  
 Excelsior Pulley Co., 21 Water St., Cuba, N. Y.  
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 Koppers Co., H., Union Arcade, Pittsburgh, Pa.  
 Semet-Solvay Co., Station B, Buffalo, N. Y.  
**BY-PRODUCT RECOVERY PLANTS**  
 Bartlett Hayward Co., Baltimore, Md.  
 Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.  
 General Reduction, Gas & By-products Co., 49 Wall St., New York  
 Isbell Porter Co., 46 Bridge St., Newark, N. J.  
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**Thompson-Levering Co.**, 325 Arch St., Philadelphia, Pa.

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Hershey Machine & Foundry Co., Manheim, Pa.

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Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

National Equipment Co., Springfield, Mass.

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**CARBIDE (Cake Form)**

Carbic Mfg. Co., Duluth, Minn.

The Metals Welding Co., 4400 Perkins Ave., Cleveland, O.

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**—Charging**

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Rich Foundry Equipment Co., 52 Vanderbilt Ave., New York, N. Y.

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Weimer Machine Works Co., Lebanon, Pa.

**—Concreting (Gasoline)**

McKeen Motor Car Co., 1222 Webster St., Omaha, Neb.

**—Core**

Foundry Equipment Co., Cleveland, O.

**—Dump**

Easton Car & Construction Co., Easton, Pa.  
Kilbourne & Jacobs Mfg. Co., Cor. Lincoln & 4th Sts., Columbus, O.

National Dump Car Co., 519 Railway Exchange Bldg., Chicago, Ill.

Wason Mfg. Co., Springfield, Mass.

Watt Mining Car Wheel Co., Barnesville, O.

**—Elevator**

Smith-Rhea Co., Baltimore, Md.

**—Freight (Drop Bottom)**

Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill.

National Dump Car Co., 519 Railway Exchange Bldg., Chicago, Ill.

Pressed Steel Car Co., Pittsburgh, Pa.

Ralston Steel Car Co., Columbus, O.

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Atlas Car & Mfg. Co., Cleveland, O.

Chase Foundry & Mfg. Co., Columbus, O.

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International Clay Machinery Co., 1057 Bohlen-der Ave., Dayton, O.

Kilbourne & Jacobs Mfg. Co., Cor. Lincoln & 4th Sts., Columbus, O.

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Steubner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y.

Stuart Foundry & Machine Works, R. J. & T. H., New Hamburg, N. Y.

Turl Iron & Car Co., Inc., 50 Broad St., New York

United Iron Works Co., Kansas City, Mo.

Watt Mining Car Wheel Co., Barnesville, O.

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

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Eagle Iron Works, Des Moines, Ia.

Easton Car & Construction Co., Easton, Pa.

Hefner & Maysilles, Grafton, W. Va.

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Herzler & Henninger Mach. Wks., Bellville, Ill.

Hockensmith Wheel & Mine Car Co., Penn Station, Pa.

Ottumwa Iron Works, Ottumwa, Ia.

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Punxsutawney Foundry & Machine Co., Punxsutawney, Pa.

Ralston Steel Car Co., Columbus, O.

Sanford-Day Iron Works, Knoxville, Tenn.

Star Mfg. Co., New Lexington, O.

United Iron Works Co., Kansas City, Missouri

Watt Mining Car Wheel Co., Barnesville, O.

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

**—Platform**

Easton Car & Construction Co., Easton, Pa.

**—Railroad**

American Car & Foundry Co., 165 Broadway, New York

Barney & Smith Car Co., Dayton, Ohio

Bettendorf Co., Bettendorf, Ia.

Bradley Car Co., Osgood, Worcester, Mass.

Brill Co., J. G., Philadelphia, Pa.

Cambria Steel Co., Philadelphia, Pa.

Chattanooga Car & Foundry Co., Chattanooga, Tenn.

Harlan & Hollingsworth Corp'n, Wilmington, Del.

Haskell & Barker Car Co., Chicago, Ill.

Keith Car & Mfg. Co., Sagamore, Mass.

Laconia Car Co., Laconia, N. H.

Pressed Steel Car Co., Pittsburgh, Pa.

Pullman Co., Pullman Bldg., Chicago, Ill.

Ralston Steel Car Co., Columbus, O.

Standard Steel Car Co., Pittsburgh, Pa.

St. Louis Car Co., St. Louis, Mo.

Wason Mfg. Co., Springfield, Mass.

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

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Wason Mfg. Co., Springfield, Mass.

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 Ave., Brooklyn, N. Y.  
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 Indianapolis, Ind.  
 Morris Engineering Co., 39 Cortlandt St., New  
 York

##### —Fig Iron

Pittsburgh Coal Washer Co., Fulton Bldg.,  
 Pittsburgh, Pa.

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Aluminum Castings Co. (Lynite), 6205  
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 Lee Co., Wm. O., Port Huron, Mich.

Light Mfg. & Foundry Co., Pottstown, Pa.  
 Pettis Co., W. W., Suite 416-17 1st Nat'l Bank  
 Bldg., Cincinnati, O.

Stewart Mfg. Corp'n, Wells St. Bridge, Chicago,  
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Columbian Bronze Corp'n, 50 Church St., N.  
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Eastwood Wire Mfg. Co., Belleville, N. J.  
 Electric Water Sterilizer & Ozone Co., Scottsdale,  
 Pa.

Eureka Mfg. Co., Lincolnton, N. C.  
 Eynon-Evans Mfg. Co., 15th & Clearfield Sts.,  
 Philadelphia, Pa.

Frain Lock Co., E. T., Lancaster, Pa.  
 Germann Bronze Co., Erie, Pa.

Grand Rapids Brass Co., 90 Scribner Ave.,  
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Niagara Brass Mfg. Co., Inc., 163 Adams St.,  
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Nolte Brass Co., Springfield, O.  
 Pacific Metal Works, 153 First St., San Francisco,  
 Cal.

Pettis Co., W. W., Suite 416-17 1st Nat'l Bank  
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Acme Die Casting Corp'n, 35th & Third Ave.,  
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American Type Founders Co., 300 Communipaw  
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Die Casting Co. of New Jersey, Irvington, N. J.

\*DOEHLER DIE-CASTING CO., Brooklyn,  
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Germann Bronze Co., Erie, Pa.

"Indiana" Die Casting Co., 11th & Cornell Sts.,  
Indianapolis, Ind.

Light Mfg. & Foundry Co., Pottstown, Pa.

Lubricating Metal Co. (Noheet), 2 Rector  
St., New York

Michigan Smelting & Refining Co., Detroit,  
Mich.

Milwaukee Die Casting Co., 297 Fourth St.,  
Milwaukee, Wis.

Moberg, Inc., C. J., Mount Vernon, N. Y.

Parker White Metal & Machine Co., 23rd &  
R. R. Sts., Erie, Pa.

Phoenix Die Casting Co., 21 Illinois St., Buffalo,  
N. Y.

Precision Castings Co., Inc., P. O. Drawer 47,  
Syracuse, N. Y.

Stewart Mfg. Corp'n, Wells St. Bridge, Chicago,  
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Veeder Mfg. Co., 20 Sargent St., Hartford,  
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## —Heavy

Carthage Machine Co., Carthage, N. Y.

Hilles & Jones Co., Wilmington, Delaware

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Abramsen Engineering Co., Union Bank Bldg.,  
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American & British Mfg. Co., Bridgeport, Conn.

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Birmingham Iron Foundry, Derby, Conn.

Bosworth Ard Mach. & Foundry Co., Anniston,  
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Burhorn Co., Edwin, 25 West Broadway, New  
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\*CALDWELL & SON CO., H. W., 17th St. &  
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Chester Steel Castings Co., Chester, Pa.

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\*CRANE CO., 836 S. Michigan Ave., Chicago,  
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Cutter, Geo. A., Taunton, Mass.

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Eureka Mfg. Co., Lincolnton, N. C.

Fairmount Foundry & Engineering Works,  
Woonsocket, R. I.

Farrar & Trefts, Inc., Perry & Illinois Sts.,  
Buffalo, N. Y.

Ferro Machine & Foundry Co., Cleveland, O.

Fillmore Ave. Foundry & Iron Works, Inc.,  
153 Fillmore Ave., Buffalo, N. Y.

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Foster, Merriam & Co., Meriden, Conn.

Franklin Machine Co., 189 Charles St., Provi-  
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Frederick Iron & Steel Co., Frederick, Md.

Frontier Iron Works, 36 Letchworth St., Buffalo,  
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Gale Mfg. Co., Albion, Mich.

Gardner General Foundry Co., Gardner, Mass.

Glover Bros., Frankford, Philadelphia, Pa.

Goodnow Foundry Co., L. H., Fitchburg, Mass.

Great Lakes Engineering Works, Detroit, Mich.

Hanson Clutch & Machinery Co., Tiffin, Ohio

Hart-Parr Co., Charles City, Iowa

Hefner & Maysilles, Grafton, W. Va.

Hershey Machine & Foundry Co., Manheim,  
Pa.

Hewes & Phillips Iron Works, Newark, N. J.

\*HILL CLUTCH CO., Cleveland, O... p. 287

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Hooven-Owens Rentschler Co., Hamilton, O.

Hubbard Steel Fndry. Co., Railroad Ave., East  
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Independent Foundry Co., 741 York St., Port-  
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Johnston & Jennings Co., E. 65th St., & N. Y. C.  
R. R., Cleveland, O.

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 Kline Hardware Co., Allentown, Pa.  
 Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill.  
 Klotz Machine Co., 318 W. Water St., Sandusky, O.  
 Kutztown Foundry & Machine Co., 421 Chestnut St., Philadelphia, Pa.  
 Lake Erie Engineering Works, Buffalo, N. Y.  
 Leavitt Mfg. Co., Urbana, Ill.  
 \*LIDGERWOOD MFG. CO., 96 Liberty St., New York. *p. 381*  
 Lobdell Car Wheel Co., P. O. Box 965, Wilmington, Del.  
 Lumsden & Van Stone Co., 426 First St., South Boston, Mass.  
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 Mecklenburg Iron Works, Charlotte, N. C.  
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 Myerstown Foundry & Mfg. Co., Inc., 90 West St., New York  
 National Foundry Mfg. & Supply Co., Williamsport, Pa.  
 Nazareth Foundry & Machine Co., 41-45 Easton Road, Nazareth, Pa.  
 Neemes Bros., 206-214 1st St., Troy, N. Y.  
 Nelsonville Foundry & Machine Co., Nelsonville, O.  
 NEW ENGLAND BUTT CO., Providence, R. I...*p. 657*  
 Newbold & Son Co., R. S., Norristown, Pa.  
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 Sneed & Co. Iron Works, Foot of Pine St., Jersey City, N. J.  
 Sowers Mfg. Co., 1300 Niagara St., Buffalo, N. Y.  
 Standard Engineering Co., Ellwood City, Pa.  
 Steacy-Schmidt Mfg. Co., 230 E. Hay St., York, Pa.  
 Sterit-Thomas Co., 32nd & Smallman Sts., Pittsburgh, Pa.  
 Stuart Foundry & Machine Works, R. J. & T. H., New Hamburg, N. Y.  
 Sun Shipbuilding Co., Chester, Pa.  
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 Thompson & Co., J., Van Horn & Sophia Sts., Philadelphia, Pa.  
 Townsend Furnace & Machine Co., Broadway & Rensselaer St., Albany, N. Y.  
 Treadwell Engrg. Co., 140 Cedar St., New York  
 Union Mfg. Co., New Britain, Conn.  
 United Engineering & Foundry Co., Farmers' Bank Bldg., Pittsburgh, Pa.  
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 \*VOGT MACHINE CO., HENRY, Louisville, Ky...*pp. 70, 71*  
 Warren Foundry & Machine Co., 11 Broadway, N. Y. C.  
 Weimer Machine Works Co., Lebanon, Pa.  
 Westbrook Elevator Mfg. Co., Inc., Danville, Va.  
 West Coast Iron Works, 4601-9 Fourteenth Ave., N. W., Seattle, Wash.  
 Wood, M. & R. M. Co., Walter A., Hoosick Falls, N. Y.  
 —Lead  
 AMERICAN TOOL & MACHINE CO., Boston, Mass...*p. 641*  
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 \*CLYDE IRON WORKS, 29th Ave., W., & Michigan St., Duluth, Minn...*p. 378*  
 \*CRANE CO., 836 S. Michigan Ave., Chicago, Ill...*pp. 138, 139, 140, 141*  
 Federal Malleable Co., West Allis, Wis.  
 Industrial Supply & Equipment Co., 407 Sansom St., Philadelphia, Pa.  
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 National Malleable Castings Co., 7706 Platt Ave., Cleveland, O.  
 Pettis Co., W. W., Suite 416-17 1st Nat'l Bank Bldg., Cincinnati, O.  
 Stowell Co., South Milwaukee, Wis.  
 Wood, M. & R. M. Co., Walter A., Hoosick Falls, N. Y.  
 —Manganese Bronze  
 \*CRANE CO., 836 S. Michigan St., Chicago, Ill...*pp. 138, 139, 140, 141*  
 Vanadium Metals Co., Groton, Conn.  
 —Manganese Steel  
 American Manganese Steel Co., 1850 McCormick Bldg., Chicago, Ill.  
 Taylor-Wharton Iron & Steel Co., High Bridge, N. J.  
 —Monel Metal  
 \*BAYONNE CASTING CO., Bayonne, N. J...*p. 406*  
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 Supplee-Biddle Hardware Co., 512 Commerce St., Philadelphia, Pa.  
 —Nickel  
 \*BAYONNE CASTING CO., Bayonne, N. J...*p. 406*  
 —Nickel Chromium  
 Driver-Harris Co., Harrison, N. J.  
 Hoskins Mfg. Co., 467 Lawton Ave., Detroit, Mich.  
 —Phosphor Bronze  
 Nolte Brass Co., Springfield, Ohio  
 —Semi-Steel  
 Birmingham Iron Foundry, Derby, Conn.  
 Central Iron Works, Stevens Point, Portage Co., Wis.  
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Pettis Co., W. W., Suite 416-17 1st Nat'l Bank Bldg., Cincinnati, O.

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\*POOLE ENGINEERING & MACHINE CO., Woodberry, Baltimore, Md... *pp. 274, 275*

Russel Wheel & Foundry Co., Detroit, Mich.

\*UNITED STATES CAST IRON, PIPE & FDRY. CO., Burlington, N. J... *p. 191*

\*VILTER MFG. CO., 1194-1196 Clinton St., Milwaukee, Wis... *pp. 12, 13*

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American Steel Foundries, 1163 McCormick Bldg., Chicago, Ill.

Atlas Steel Casting Co., 1963 Elmwood Ave., Buffalo, N. Y.

Bayonne Steel Casting Co., Oak St., Bayonne, N. J.

Bethlehem Steel Co., Bethlehem, Pa.

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

Chester Steel Castings Co., Chester, Pa.

\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp. 138, 139, 140, 141*

Egan-Rogers Steel & Iron Co., Crum Lynne, Pa.

Erie Forge Co., Erie, Pa.

FALK CO., Milwaukee, Wis... *pp. 262, 263*

Federal Steel Foundry Co., Chester, Pa.

Gerlinger Steel Castings Co., Milwaukee, Wisc.

Hart-Parr Co., Charles City, Iowa

Hubbard Steel Fndry. Co., Railroad Ave., East Chicago, Ind.

KELLY & JONES CO., Greensburg, Pa... *pp. 150-151*

Lobdell Car Wheel Co., P. O. Box 965, Wilmington, Del.

Lombard Iron Work & Supply Co., Augusta, Ga.

McCord & Co., Chicago, Ill.

MALLEABLE IRON FITTINGS CO., Branford, Conn... *p. 191*

Massilon Steel Casting Co., Massilon, O.

Millbury Steel Foundry Co., Millbury, Mass.

National Steel Casting Co., Montpelier, Ind.

Ohio Steel Foundry Co., Springfield, O.

Otis Steel Co., 3131 Lakeside Ave., Cleveland, O.

Penn Seaboard Steel Corp'n, Franklin Bank Bldg., Philadelphia, Pa.

Pettis Co., W. W., Suite 416-17 1st Nat'l Bank Bldg., Cincinnati, O.

Philadelphia Roll & Machine Co., 23rd St. & Washington Ave., Philadelphia, Pa.

Pittsburgh Iron & Steel Foundries Co. (Adamite), 314 Oliver Bldg., Pittsburgh, Pa.

Reading Steel Casting Co., Reading, Pa.

Reliance Steel Casting Co., 28th & Smallman St., Pittsburgh, Pa.

Sivyer Steel Casting Co., Milwaukee, Wis.

Standard Steel Works Co., Morris Bldg., Philadelphia, Pa.

Sterrit-Thomas Fndry. Co., 32nd & Smallman Sts., Pittsburgh, Pa.

Strong Steel Fndry. Co., 33 Norris St., Buffalo, N. Y.

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Treadwell Engrg. Co., 140 Cedar St., New York

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Union Steel Casting Co., Pittsburgh, Pa.  
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Wharton, Jr. & Co., Ind., Wn., P. O. Box 124, Easton, Pa.

Wheeling Mold & Foundry Co., Farmers' Bank Bldg., Pittsburgh, Pa.

—**Structural Iron**

Marshall Foundry Co., 1st Nat'l Bank Bldg., Pittsburgh, Pa... *p. 670*

—**Vanadium Bronze**

Vanadium Metals Co., Groton, Conn.

—**Vanadium Steel**

Sivyer Steel Casting Co., Milwaukee, Wis.

—**Wear-Resistant**

American Abrasive Metals Co., 50 Church St., New York, N. Y.

—**White Metal**

D'Este Co., Julian, 26 Canal St., Boston, Mass. *pp. 166, 167*

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Parker White Metal & Machine Co., 23rd & R. R. Sta., Erie, Pa.

UNITED LEAD CO., 111 Broadway, New York *p. 402*

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SWENSON EVAPORATOR CO., 945 Monadnock Block, Chicago, Ill... *p. 633*

—**CEMENT**

—**Asbestos**

Hartford Covering Co., 1234 Main St., Hartford, Conn.

\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p. 162*

—**Belt**

Alexander Bros., 414 N. 3rd St., Philadelphia, Pa.

Bradford Belting Co., 202 Walnut St., Cincinnati, O.

Cling-Surface Co., 1048 Niagara St., Buffalo, N. Y.

Grand Rapids Belting Co., 1-3 Ionia Ave., Grand Rapids, Mich.

GRATON & KNIGHT MFG. CO., Worcester, Mass... *p. 321*

Jewell Belting Co., Hartford, Conn.

LADEW CO., INC., EDWARD R., Glen Cove, N. Y... *pp. 324, 325*

MacWatty Belting Co. (Stickfast), 7 Beverly St., Providence, R. I.

Ulmer Leather Co., Norwich, Conn.

—**Caulking**

Clark Cast Steel Cement Co., Shelton, Conn.

—**Disc Wheel**

Gardner Machine Co., Beloit, Wis.

—**Fire Brick**

\*JOINTLESS FIRE BRICK CO., 1879 Kingsbury St., Chicago, Ill... *p. 116*

—**Iron and Steel**

Clark Cast Steel Cement Co., Shelton, Conn.

Smooth-On Mfg. Co., 570-574 Communipaw Ave., Jersey City, N. J.

—**Pipe Joint**

Chard & Howe (Deegan's), 250 Front St., New York

\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp. 138, 139, 140, 141*

\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p. 200*

Smooth-On Mfg. Co., 570-574 Communipaw Ave., Jersey City, N. J.

United States Graphite Co., Saginaw, Mich.

—**Refractory**

Betson Plastic Fire Brick Co., Inc. (Hi-Heat), Rome, N. Y.

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Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

#### —Jet

Blake Pump & Condenser Co., Fitchburg, Mass.

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##### —Fibre

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**Automatic Switch Co.**, 4-6 White St., New York

**Cline Electric Mfg. Co.**, Fisher Bldg., Chicago, Ill.

**Crandon Mfg. Co.**, 105 Middle St., Portland, Me.  
**Cutler-Hammer Mfg. Co.**, 12th St. & St. Paul Ave., Milwaukee, Wis.

**Electric Controller & Mfg. Co.**, Cleveland, O.  
**Fort Wayne Engineering & Mfg. Co. (Paul)**, Fort Wayne, Ind.

\***GENERAL ELECTRIC CO.**, Schenectady, N. Y... *pp. 16-25, inc.*

**General Elevator Co.**, 29 Broadway, New York

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**Wheeler-McDowell Elevator Co.**, 417-421 Canal St., New York

—**Elevator**

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—**Belt**  
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Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

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Philadelphia Copper-smithing Co., 222-226 N. Front St., Philadelphia, Pa.

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**COTTON MANUFACTURING MACHINERY**

Carver Cotton Gin Co., East Bridgewater, Mass.

Curtis & Marble Machine Co., 78 Cambridge St., Worcester, Mass.

Liddell Co., Charlotte, N. C.

Lummus Cotton Gin Sales Co., Dallas, Tex.

Saco-Loell Shops, 77 Franklin St., Boston, Mass.

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Acme Asbestos Covering & Supply Co., 407 N.  
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**Standard Asbestos Mfg. Co.**, Chicago, Ill.  
**Wyckoff & Son Co.**, A., Elmira, N. Y.

**—Tank**

**Armstrong Cork & Insulation Co.**, Pittsburgh, Pa.  
**Central Asbestos & Magnesite Co.**, 214-216 W. Grand Ave., Chicago, Ill.  
**Hartford Covering Co.**, 1234 Main St., Hartford, Conn.  
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**Euclid Crane & Hoist Co.**, Euclid, O.  
**Gilbert-Grant Co.**, 141 Broadway, N. Y. C.  
**Granger Co.**, A. D., 15 Park Row, New York  
**Hay's Sons**, Sam'l W., 6907 Phipps Power Bldg., Pittsburgh, Pa.  
**Kinney, J. N.**, 30 Church St., New York  
**Lane Mfg. Co.**, Montpelier, Vt.  
**Manning, Maxwell & Moore, Inc.**, 119 W. 40th St., New York  
**Maris Bros.**, 56th & Gray's Ave., Philadelphia, Pa.  
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Byers Machine Co., John F., Ravenna, O.

Carroll Foundry & Machine Co., Bucyrus, O.

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Thew Automatic Shovel Co., Lorain, Ohio

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Leard Co., Wm. E., 16th St. & 5th Ave., New  
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**CRUSHER PARTS**

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Standard Equipment Co., 185 Church St., New Haven, Conn.

Sterrit-Thomas Fndry Co., 32nd &amp; Smallman Sts., Pittsburgh, Pa.

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—**Tilting**  
Ross, George A., 1951 W. Madison St., Chicago, Ill.

# **CUPS, OIL AND GREASE**

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Rich Mfg. Co., 370 Atlantic Ave., Boston, Mass.

# **CUTTERS**

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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
Lewthwaite Machine Co., T. H., 415 E. 31st St., New York

## —**Boiler Tube**

Faessler Mfg. Co., J., Moberly, Mo.

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Salisbury Foundry & Machine Co., Salisbury, Md.

Skinner Co., M. B. (Wernicke), 558-562 Washington Blvd., Chicago, Ill.

Union Machine Co., 183 University Ave., St. Paul, Minn.

## —**Bolt**

Acme Machinery Co., 4533 St. Clair Ave., N. E., Cleveland, O.

Brown Co., H. B., East Hampton, Conn.

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## —**Gauge Glass**

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Advance Tool Co., Cincinnati, O.

Alvord Reamer & Tool Co., Millersburg, Pa.

Barbar-Colman Co., Rockford, Ill.

Becker Milling Machine Co., Hyde Park, Boston, Mass.

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Cowles Tool Co., 2086 W. 110th St., Cleveland, O.

Davidson Tool Mfg. Corp'n, 120-124 Maiden Lane, New York

Detroit Reamer & Tool Co., 302 Congress St., East Detroit, Mich.

Detroit Twist Drill Co., Cor. Fort and 14th St., Detroit, Mich.

Gairing-Needham Tool Co., Inc., Vernon Bldg., Detroit, Mich.

Gale-Sawyer Co., 36 Oliver St., Boston, Mass.

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Ingersoll Milling Machine Co., Rockford, Ill.

Lincoln Twist Drill Co., Taunton, Mass.

Lovejoy Tool Co., Inc., Springfield, Vt.

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Saunders' Sons, Inc., D., 21 Atherton St., Yonkers, N. Y.

Toledo Pipe Threading Machine Co. (Toledo), 1445 Summit St., Toledo, O.

Trimont Mfg. Co. (Trimo), Roxbury, Boston, Mass.

## —**Sheet Metal**

Savage Co., W. J., Knoxville, Tenn.

## —**Sprue**

Tessmer Machine & Tool Co., 285-91 Rivard St., Detroit, Mich.

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Bastian-Blessing Co., West Austin Ave. at La Salle St., Chicago, Ill.

Cox Brass Mfg. Co., Albany, N. Y.

Imperial Brass Mfg. Co. (Imperial), 1200 W. Harrison St., Chicago, Ill.

**\*INTERNATIONAL OXYGEN CO.,** 796 Frelinghuysen Ave., Newark, N. J... *p. 567*

The Metals Welding Co., 4400 Perkins Ave., Cleveland, O.

## —**Oxy-Hydrogen**

Bastian-Blessing Co., W. Austin Ave. at La Salle St., Chicago, Ill.

Burdett Mfg. Co., 309 St. Johns Court, Chicago, Ill.

**\*INTERNATIONAL OXYGEN CO.,** 796 Frelinghuysen Ave., Newark, N. J... *p. 567*

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Dexter Folder Co., 200 5th Ave., New York

Malm Engineering Co., 588 Drexel Bldg., Philadelphia, Pa.

Oswego Machine Works, Oswego, N. Y.

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Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Earle Gear &amp; Machine Co. (Lea Simplex), Stenton &amp; Wyoming Aves., Wayne Junction, Philadelphia, Pa.

Esen-Lucas Machine Works, Front St. &amp; Girard Ave., Philadelphia, Pa.

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Shannon &amp; Co., J. Jacob, 1744 Market St., Philadelphia, Pa.

Superior Iron Works Co., Superior, Wis.

**DESTRUCTORS, REFUSE**

Borge Incinerator Corp'n, 1216 Flatiron Bldg., New York

Decarie Incinerator Co., 817 McKnight Bldg., Minneapolis, Minn.

Jarvis Engineering Co., 261 Franklin St., Boston, Mass.

Twin Fire Furnace Co., 1252 First National Bank Bldg., Chicago, Ill.

Washburn &amp; Granger, 50 Church St., New York

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**DIAPHRAGMS, RUBBER**

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**DIE SINKING MACHINES**

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 Becker Milling Machine Co., Hyde Park, Boston, Mass.  
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Merritt Mfg. Co., Lockport, N. Y.

\*PHILADELPHIA DRYING MACHINERY CO., Stokely St., Philadelphia, Pa. .*p.* 630

\*PHILADELPHIA TEXTILE MACHINERY CO., Philadelphia, Pa. .*p.* 631

—**Meal**

Louisville Drying Machinery Co., 451 Baxter Ave., Louisville, Ky.

—**Raw Stock**

\*PHILADELPHIA TEXTILE MACHINERY CO., Philadelphia, Pa. .*p.* 631

—**Rotary**

American Process Co., 68 William St., New York

BARTLETT & SNOW CO., C. O., Cleveland, O. .*p.* 336

BONNOT CO., Canton, O. .*p.* 620

Cummer & Son Co., F. D. ("Cummer"), 413 The Arcade, Cleveland, O.

GALLAND-HENNING MFG. CO., 26th-27th Ave. & Layton Park, Milwaukee, Wis. .*p.* 611

General Reduction, Gas & By-Products Co., 49 Wall St., New York

Grupe Drier & Boiler Co., 325-331 E. Second St., Davenport, Ia.

Hersey Mfg. Co., South Boston, Mass.

Louisville Drying Machinery Co., 451 Baxter Ave., Louisville, Ky.

Mashek Engineering Co., 90 West St., New York

PHOENIX IRON WORKS CO., Meadville, Pa. .*p.* 671

\*PULVERIZED . FUEL EQUIPMENT CORP'N, 30 Church St., New York. .*p.* 108

RUGGLES-COLES ENGINEERING CO., 50 Church St., New York. .*p.* 632

Sterrit-Thomas Endry Co., 32nd & Smallman Sts., Pittsburgh, Pa.

—**Sand**

BARTLETT & SNOW CO., C. O., Cleveland, O. .*p.* 336

CONNERY & CO., INC., 2nd & Luzerne Sts., Philadelphia, Pa. .*p.* 668

—**Shell (Steam Jacketed)**

Perrin & Co., W. R., Room 290-37 West Van Buren St., Chicago, Ill.

—**Tobacco**

\*PHILADELPHIA DRYING MACHINERY CO., Stokely St., Philadelphia, Pa. .*p.* 630

—**Vacuum**

BARTLETT & SNOW CO., C. O., Cleveland, O. .*p.* 336

Buffalo Foundry & Machine Co., E. Perry St. & Fillmore Ave., Buffalo, N. Y.

DEVINE CO., J. P., Buffalo, N. Y. .*pp.* 626, 627

Kestner Evaporator Co., 18th & Allegheny Ave., Philadelphia, Pa.

KOVEN & BROTHER, L. O., 154 Ogden Ave., Jersey City, N. J. .*p.* 628

MARSHALL FOUNDRY CO., 1st Natl. Bank Bldg., Pittsburgh, Pa. .*p.* 670

—**Yarn**

\*PHILADELPHIA TEXTILE MACHINERY CO., Philadelphia, Pa. .*p.* 631

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AMERICAN BLOWER CO., Detroit, Mich. .*pp.* 578, 579

Anderson Co., V. D., W. 95th St., Cleveland, O.

ATMOSPHERIC CONDITIONING CORP'N, 435 Chestnut St., Philadelphia, Pa. .*p.* 634

BARTLETT & SNOW CO., C. O., Cleveland, O. .*p.* 336

\*CARRIER ENGINEERING CORP'N, 39 Cortlandt St., New York. .*p.* 635

Colorado Iron Works Co., Box 989, Denver, Colo.

Cutter, Geo. A., Taunton, Mass.

Drying Systems, Inc., 322 W. Michigan Ave., Chicago, Ill.

GALLAND-HENNING MFG. CO., 26th-27th Ave. & Layton Park, Milwaukee, Wis. .*p.* 611

Gordon Engineering Corp'n, 39 Cortlandt St., New York

Hun Berry Fan Co., A., 28 Binford St., Boston, Mass.

MARSHALL FOUNDRY CO., 1st Natl. Bank Bldg., Pittsburgh, Pa. .*p.* 670

Merrill, Inc., C. J. 85 Kennebec St., Portland, Me.

NEW YORK BLOWER CO., 608 S. Dearborn St., Chicago, Ill... *p. 580*

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RUGGLES-COLES ENGINEERING CO., 50 Church St., New York. *p. 632*

Seymour, Jr., J. M., 51-53 Lawrence St., Newark, N. J.

SKINNER BROS. MFG. CO., 10th & Tyler Sts., St. Louis, Mo. *p. 637*

Stearns-Roger Mfg. Co., 1718-1720 California St., Denver, Colo.

\*STURTEVANT CO., B. F., Hyde Park, Boston, Mass. *pp. 90, 91*

SWENSON EVAPORATOR CO., 945 Monadnock Block, Chicago, Ill. *p. 633*

#### DRYING MACHINES (Blue Print)

REVOLUTE MACHINE CO., 417 E. 93rd St., New York. *p. 679*

#### DUMBWAITERS

Marshall Bros. Co., 21st & Mary Sts., South Side, Pittsburgh, Pa.

Sedgwick Machine Works, 146 W. 15th St., New York

Speidel, J. G., Reading, Pa.

Standard Electric & Elev. Co., 123 S. Calvert St., Baltimore, Md.

Storm Mfg. Co., 50 Vesey St., Newark, N. J.

#### —Electric

Bates Elevator Co., 211 President St., Baltimore, Md.

General Elevator Co., 29 Broadway, New York

Marshall Bros. Co., 21st & Mary Sts., South Side, Pittsburgh, Pa.

Roberts Elevator Co., James H., 430 W. Broadway, New York

See Electric Elevator Co., A. B., 220 Broadway, New York

Storm Mfg. Co., 50 Vesey St., Newark, N. J.

Warner Elevator Mfg. Co., Cincinnati, Ohio

#### DUMP CARS

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#### DUST COLLECTING SYSTEMS

ATMOSPHERIC CONDITIONING CORP'N, 435 Chestnut St., Philadelphia, Pa. *p. 634*

Clark Dust Collecting Co., Fisher Bldg., Chicago, Ill.

Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.

Dixie Mfg. Co., Inc., Russell St. & B. O. O. R. R., Baltimore, Md.

Hoevel Mfg. Co., 170 Ogden Ave., Jersey City

Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

Merrill, C. J., Inc., 85 Kennebed St., Portland, Me.

Northern Blower Co., Cleveland, Ohio

\*PANGBORN CORP'N, P. O. Box 859, Hagerstown, Md. *pp. 652, 653*

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STROUD & CO., E. H., 928-934 Fullerton Ave., Chicago, Ill. *pp. 622, 623*

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ATMOSPHERIC CONDITIONING CORP'N, 435 Chestnut St., Philadelphia, Pa. *p. 634*

Cyclone Blow Pipe Co., 2552 W. 21st St., Chicago, Ill.

Dixie Mfg. Co., Inc., Russell St. & B. O. O. R. R., Baltimore, Md.

Hersh & Bro. (Bicalky), Allentown, Pa.

Knickerbocker Co., Jackson, Mich.

Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

Parson Co., J. W., 1021 N. Delaware Ave., Philadelphia, Pa.

SKINNER BROS. MFG. CO., 10th & Tyler Sts., St. Louis, Mo. *p. 637*

Sly Mfg. Co., W. W., Cleveland, O.

\*STURTEVANT CO., B. F., Hyde Park, Boston, Mass. *pp. 90, 91*

#### —Cloth

Clark Dust Collecting Co., Fisher Bldg., Chicago, Ill.

Illinois Mfg. & Supply Co., Quincy, Ill.

STROUD & CO., 928-934 Fullerton Ave., Chicago, Ill. *pp. 622, 623*

#### —Metal

Allingron & Curtis Mfg. Co., 400 Holden St., Saginaw, Mich.

Clark Dust Collecting Co., Fisher Bldg., Chicago, Ill.

Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.

Northern Blower Co., W. 65th & Dennison Ave., Cleveland, O.

STROUD & CO., E. H., 928-934 Fullerton Ave., Chicago, Ill. *pp. 622, 623*

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#### DYEING MACHINERY

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\*PHILADELPHIA DRYING MACHINERY CO., Stokely St., Philadelphia, Pa. *p. 630*

#### DYNAMOMETERS

Chatillon & Sons, John, 85-93 Cliff St., New York

\*GENERAL ELECTRIC CO., Schenectady, N. Y. *pp. 16, 25, inc.*

Sprague Electric Works, 527 W. 34th St., New York

Standard Motor Construction Co., 174 Whiton St., Jersey City, N. J.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. *pp. 128, 129*

#### —Tractor

Burr Co., Champaign, Ill.

E

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\*GREEN FUEL ECONOMIZER CO., 90 West St., New York. *p. 74*

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Hancock Inspirator Co., 119 W. 40th St., New York

Hayden & Derby Mfg. Co., 119 W. 40th St., New York

PENBERTHY INJECTOR CO., Detroit, Mich. *p. 183*

Tranter Mfg. Co., 105 Water St., Pittsburgh, Pa.

#### —Ash (Hydraulic)

Great Lakes Engineering Works, Detroit, Mich.

Parson Manufacturing Co., P. O. Box 212, Elizabeth, N. J.

#### —Ash (Suction)

American Steam Conveyor Corp'n, 326 W. Madison St., Chicago, Ill.

#### —Sewage

Kerr Machinery Corp., Kerr Building, Detroit, Mich.

Latta-Martin Pump Co., Hickory, N. C.

#### —Sewage (Centrifugal)

Simplex Ejector Co., 1050 Randolph St., Chicago, Ill.

**EJECTORS (Continued)**

Twinvolute Pump & Mfg. Co., 216-223 High St., Newark, N. J.

Yeomans Bros. Co. (Yeomans), 231 Institute Place, Chicago, Ill.

**—Sewage (Pneumatic)**

Pacific Flush Tank Co., 149 Broadway, New York

Simplex Ejector Co., 1050 Randolph St., Chicago, Ill.

Yeomans Bros. Co. (Shone), 231 Institute Place, Chicago, Ill.

**ELBOWS, UNION**

Bard Union Co., Inc., Norwich, Conn.

\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp. 138, 139, 140, 141*

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**ELECTRICAL MACHINERY**

Adams-Bagnall Electric Co., Cleveland, O.

\*ALLIS-CHALMERS MFG. CO., Milwaukee, Wis... *pp. 4, 5*

Electro-Dynamic Co., Bayonne, N. J.

Electric Machinery Co., Minneapolis, Minn.

\*GENERAL ELECTRIC CO., Schenectady, N. Y... *pp. 16-25, inc.*

General Vehicle Co., Inc., Long Island City, N. Y.

Ideal Electric & Mfg. Co., Mansfield, O.

Langstadt Meyer Co., Appleton, Wis.

Maintenance Co., 417-421 Canal St., New York, N. Y.

Roth Bros. & Co., 1400 W. Adams St., Chicago, Ill.

Standard Construction Engrg. & Supply Co., 1752 N. 29th St., Philadelphia, Pa.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa... *pp. 128, 129*

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Hubbell, Inc., Harvey, Bridgeport, Conn.

**ELECTRICAL SUPPLIES**

Adams-Bagnall Electric Co., Cleveland, O.

BENJAMIN ELECTRIC MFG. CO., 395 Wash. Blvd., Chicago, Ill... *p. 684*

Craghead Engineering Co., 340-342 Main St., Cincinnati, O.

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\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p. 200*

Maintenance Co., 417-421 Canal St., New York, N. Y.

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Risdon Tool & Machine Co., Naugatuck, Conn.

Sterling Varnish Co., 528 Fulton Bldg., Pittsburgh, Pa.

Waterbury Battery Co., Waterbury, Conn.

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\*GENERAL ELECTRIC CO., Schenectady, N. Y... *pp. 16, 25, inc.*

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa... *pp. 128, 129*

\*WESTON ELECTRICAL INSTRUMENT CO., 49 Weston Ave., Waverly Park, Newark, N. J... *p. 253*

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Acheson Graphite Co., Niagara Falls, N. Y.

**—Arc Welding**

\*QUASI ARC WELTRODE CO., INC., 2897 Atlantic Ave., Brooklyn, N. Y... *p. 566*

**ELECTROTYPING MACHINERY**

Hoe & Co., R., 504-520 Grand St., New York, N. Y.

**ELEVATING AND CONVEYING MACHINERY**

Alvey-Ferguson Co., 75 North Ave., Oakley, Cincinnati, O.

Alvey Mfg. Co., 3201 S. Broadway, St. Louis, Mo.

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\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill... *p. 337*

\*CHAIN BELT CO., Milwaukee, Wis... *pp. 132, 133*

Conant Machine Co., Concord Junction, Mass.

Dull Co., Raymond W., 111 W. Washington St., Chicago, Ill.

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\*JONES FOUNDRY & MACHINE CO., W. A., 4401-4451 West Roosevelt Road, Chicago, Ill... *pp. 268, 269, 270, 271*

\*LINK-BELT CO., Philadelphia, Pa... *p. 341*

Maintenance Co., 417-421 Canal St., New York, N. Y.

MATHEWS GRAVITY CARRIER CO., Ellwood City, Pa... *pp. 348, 349, 350, 351*

Meese & Gottfried Co., 660 Mission St., San Francisco, Cal.

Moore Co., George W., 2144 Fulton St., Chicago, Ill.

Olson & Co., Samuel, 2418-22 Bloomingdale Ave., Chicago, Ill.

ROBINS CONVEYING BELT CO., Park Row Bldg., New York... *p. 353*

Scottdale Machine & Mfg. Co., Scottdale, Pa.

STANDARD CONVEYOR CO., North St. Paul, Minn... *p. 357*

Stephens-Adamson Mfg. Co., Aurora, Ill.

Sturtevant Mill Co., Harrison Square, Boston, Mass.

Union Engineering Co., Cuyahoga & W. 4th St., Cleveland, O.

Car Works, Decatur, Ill.

Webster Mfg. Co., Tiffin, O.

WELLER MFG. CO., 1820-1856 N. Kostner Ave., Chicago, Ill... *pp. 354, 355, 356*

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Maintenance Co., 417-421 Canal St., New York, N. Y.

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Wheeler-McDowell Elevator Co., 417-421 Canal St., New York

**ELEVATOR CABS AND ENCLOSURES**

Cincinnati Mfg. Co., Cincinnati, O.

Kamman Mfg. Co., Walter, 3264 Spring Grove Ave., Cincinnati, O.

Ohio Elevator & Machine Co., Columbus, O.

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—Automobile

Warner Elevator Mfg. Co., Cincinnati, O.



## —Bucket and Chain

Standard Sand &amp; Machine Co., Cleveland, Ohio

## —Electric

American Elevator &amp; Machine Co., Louisville, Ky.

Bates Elevator Co., 211 President St., Baltimore, Md.

Eastern Machinery Co., New Haven, Conn.

General Elevator Co., 29 Broadway, New York

Gurney Co., Honesdale, Pa.

Gurney Elevator Co., 62 W. 45th St., New York

Houghton Elevator &amp; Machine Co., 671-693

Spencer St., Toledo, O.

Kieckhefer Elevator Co., A., 1026-1104 St. Paul

Ave., Milwaukee, Wis.

Kimball Bros. Co., Council Bluffs, Ia.

\*LAMSON CO., 100 Boylston St., Boston, Mass.

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McLaughlin Co., Geo. T., 120 Fulton St., Boston,

Mass.

Maintenance Co., 417-421 Canal St., New York,

N. Y.

Moore &amp; Wyman Elevator &amp; Machine Works,

Granite &amp; Richard Sts., Boston, Mass.

Reedy Co., H. J., Cincinnati, O.

Roberts Elevator Co., James H., 430 W. Broad-

way, New York

See Electric Elevator Co., A. B., 220 Broadway,

New York

Sidney Elevator Mfg. Co., Sidney, O.

Speidel, J. G., Reading, Pa.

Warner Elevator Mfg. Co., Cincinnati, O.

Wheeler-McDowell Elevator Co., 417-421 Canal

St., New York

## —Hand Power

Bates Elevator Co., 211 President St., Baltimore,

Md.

Kimball Bros. Co., Council Bluffs, Ia.

\*LAMSON CO., 100 Boylston St., Boston, Mass.

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Sedgwick Machine Works, 146 W. 15th St., New

York

Sidney Elevator Mfg. Co., Sidney, O.

Speidel, J. G., Reading, Pa.

Warner Elevator Mfg. Co., Cincinnati, O.

## —Hydraulic

Harris Ice Machine Works, 174 E. Water St.,

Portland, Ore.

Houghton Elevator &amp; Machine Co., 671-693

Spencer St., Toledo, O.

Standard Plunger Elevator Co., 243 Stafford St.,

Worcester, Mass.

## —Hydraulic Plunger

General Elevator Co., 29 Broadway, New York

Kieckhefer Elevator Co., A., 1026-1104 St. Paul

Ave., Milwaukee, Wis.

Standard Plunger Elevator Co., 243 Stafford St.,

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## —Passenger and Freight

Albro-Clem Elevator Co., Erie Ave. &amp; D St.,

Philadelphia, Pa.

American Elevator &amp; Machine Co., Louisville,

Ky.

Baker Iron Works, 950 N. Broadway, Los

Angeles, Cal.

Eastern Machinery Co., New Haven, Conn.

General Elevator Co., 29 Broadway, New York

Gurney Co., Honesdale, Pa.

Gurney Elevator Co., 62 W. 45th St., New York

Houghton Elevator &amp; Machine Co., 671-693

Spencer St., Toledo, O.

Kieckhefer Elevator Co., A., 1026-1104 St. Paul

Ave., Milwaukee, Wis.

Kimball Bros. Co., Council Bluffs, Ia.

McLaughlin Co., Geo. T., 120 Fulton St., Bos-

ton, Mass.

Maintenance Co., 417-421 Canal St., New York,

N. Y.

Mason &amp; Co., Inc., Volney W., 2 Lafayette St.,

Providence, R. I.

Moore &amp; Wyman Elevator &amp; Machine Works,

Granite &amp; Richard Sts., Boston, Mass.

Ohio Elevator &amp; Machine Co., Columbus, O.

Otis Elevator Co., 11th Ave. &amp; 26th St., New

York

Park Mfg. Co., Charlotte, N. C.

Reedy Co., H. J., Cincinnati, O.

Ridgway &amp; Son Co., Craig, Coatesville, Pa.

See Electric Elevator Co., A. B., 220 Broadway,

New York

Sidney Elevator Mfg. Co., Sidney, O.

Smith-Rhea Co., Baltimore, Md.

Speidel, J. G., Reading, Pa.

Standard Electric &amp; Elev. Co., 123 S. Calvert

St., Baltimore, Md.

Standard Plunger Elevator Co., 243 Stafford St.,

Worcester, Mass.

Storm Mfg. Co., 50 Vesey St., Newark, N. J.

Warner Elevator Mfg. Co., Cincinnati, Ohio

Westbrook Elevator Mfg. Co., Inc., Danville, Va.

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## —Steam-Hydraulic

Ridgway &amp; Son Co., Craig, Catesville, Pa.

## —Telescopic

American Machinery Co., 103 W. Water St.,

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## —Traction

McLaughlin Co., Geo. T., 120 Fulton St., Boston,

Mass.

Reedy Co., H. J., Cincinnati, O.

Waner Elevator Mfg. Co., Cincinnati, O.

## EMERY WHEELS

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## ENAMELING

Pickling Enameling Corp'n, Second at Webster

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Air Device Mfg. Co., 2977 Cottage Grove Ave., Chicago, Ill.

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Consolidated Engine Stop Co., 350 W. 38th St., New York

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Maintenance Co., 417-421 Canal St., New York, N. Y.

Phoenix Automatic Filter Co., 315-317 6th St., Racine, Wis.

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American Engine Co., 2nd & Amsterdam Ave., Detroit, Mich.

American Whaley Engine Co., 136 Federal St., Boston, Mass.

Angels Iron Works, Angels Camp, Cal.

Angola Gas Engine Co., Angola, Ind.

Augustine Automatic Rotary Engine Co., 1862 Elmwood Ave., Buffalo, N. Y.

Backus Water Motor Co., 172-182 Pennsylvania Ave., Newark, N. J.

Bartlett Hayward Co. (White & Middleton), Baltimore, Md.

Benninghofen Sons, C., Hamilton, O.

Bessemer Gas Engine Co., Grove City, Pa.

Buckeye Engine Co., Salem, O.

Buffalo Gasoline Motor Co., 1280 Niagara St., Buffalo, N. Y.

Bruce-MacBeth Engine Co., Cleveland, O.

Butler Engine & Foundry Co., Butler, Pa.

Callahan Co., W. P., Dayton, O.

Clay Engine Co., 6950 Kinsman Road, Cleveland, O.

Cook Motor Co., Delaware, O.

Cooper Co., C. & G., Mt. Vernon, O.

Dissinger & Bro., Inc., C. H. A., Wrightsville, Pa.

DuBois Iron Works, 805 Brady Sts., DuBois, Pa.

Fairbanks Co., 416-422 Broome St., New York

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Foos Gas Engine Co., Springfield, O.

Galloway Co., Wm., Waterloo, Ia.

Hall Gas Engine Co., Bridesburg, Philadelphia, Pa.

Hooven, Owens, Rentschler Co., Hamilton, O.

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Jacobson Engineering Co., Albany, N. Y.

Jacobson Machine Mfg. Co., Warren, Pa.

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LaZier Gas Engine Co., Buffalo, N. Y.

Lucey Mfg. Corp'n, Woolworth Bldg., New York

The Meriam Co., 8405 Detroit Ave., Cleveland, O.

Mesta Machine Co., Box 1124, Pittsburgh, Pa.

Middletown Machine Co. (Woodpeckers), Middletown, Ohio

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Olin Gas Engine Co., 10 Lock St., Buffalo, N. Y.

Otto Engine Mfg. Co., 33rd & Walnut Sts., Philadelphia, Pa.

Page Engineering Co., Foot Latrobe Park, Baltimore, Md.

Portsmouth Engine Co., Portsmouth, O.

Rathbun-Jones Engineering Co., Toledo, O.

Reeves Engineering Co., Trenton, N. J.

Rollins Engine Co., Nashua, N. H.

Ruger Mfg. Co., J. W., 222 Chicago St., Buffalo, N. Y.

Schramm & Son, Inc., Chris. D., 709 Arch St., Philadelphia, Pa.

Southern Engine & Boiler Works, Jackson, Tenn.

Standard Gas Engine Co., East Oakland, Cal.

Superior Gas Engine Co., Springfield, O.

Titusville Machine & Fndry. Co., Titusville, Pa.

Turner-Fricke Mfg. Co., Pittsburgh, Pa.

Union Tool Co., Torrance, Cal.

United Engine Co., Lansing, Mich.

Western Machinery Co., 900 N. Main St., Los Angeles, Cal.

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Witte Engine Works, Kansas City, Mo.

Wolverine Motor Works, Union Ave., Bridgeport, Conn.

**—Gas, Natural**

Alberger Gas Engine Co., 285 Chicago St., Buffalo, N. Y.

Bruce-MacBeth Engine Co., Cleveland, O.

Buckeye Machine Co., Lima, O.

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Miller Improved Gas Engine Co., Springfield, O.

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Schenck Mfg. & Supply Co., Parkers Landing, Pa.

—Gasoline

Abenague Machine Works, Inc., Westminster Station, Vt.

Advance Mfg. Co. (Hamilton), Hamilton, O.

Aerothrust Engine Co., LaPorte, Mo.

Alamo Engine Co., Hillsdale, Mich.

American-Blakeslee Mfg. Co., Birmingham, Ala.

Anderson Engine Co., 4036 N. Rockwell St., Chicago, Ill.  
 Angola Gas Engine Co., Angola, Ind.  
 Associated Manufacturers Co., Waterloo, Ia.  
 Automatic Machine Co., Bridgeport, Conn.  
 Bartlett Hayward Co. (White & Middleton), Baltimore, Md.  
 Bauroth Brothers, Springfield, O.  
 Benninghofen Sons, C., Hamilton, O.  
 Blount Engineering Co., 100 High St., Boston, Mass.  
 Bond Co., Harold [L. (Atlantic), 383-91 Atlantic Ave., Boston, Mass.  
 Brownwall Engine & Pulley Co., 12 W. 4th St., Holland, Mich.  
 Bryant Co., 1025 South Menard Ave., Chicago, Ill.  
 Buckeye Machine Co., Lima, O.  
 Buckeye Mfg. Co., Anderson, Ind.  
 Burlingame, S. F., W. Boylston St., Worcester, Mass.  
 Callahan Co., W. P., Dayton, O.  
 Carbone & Co., A., 114 Centre St., New York  
 Castle Engineering Co., Inc., A. M., La Crosse, Wis.  
 Central Iron Works, Stevens Point, Portage Co., Wis.  
 Charter Gas Engine Co., Sterling, Ill.  
 Christensen Engineering Co., 841 30th St., Milwaukee, Wis.  
 Clark Bros. Co., Olean, N. Y.  
 Clay Engine Co., 6950 Kinsman Road, Cleveland, O.  
 Climax Engineering Co., Clinton, Ia.  
 \*CLYDE IRON WORKS, 29th Ave., W., & Michigan St., Duluth, Minn... *p. 378*  
 Cook Motor Co., Delaware, O.  
 Domestic Engine & Pump Co., Shippenburg, Pa.  
 DuBois Iron Works, 805 Brady St., DuBois, Pa.  
 Enterprise Machinery Co., Minneapolis, Minn.  
 Evansville Gas Engine Works, 1230 Riverside Ave., Evansville, Ind.  
 FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 599*  
 Fairmont Gas Engine & Railway Motor Car Co., North Main St., Fairmont, Minn.  
 Fay & Bowen Engine Co., Geneva, N. Y.  
 Field-Brundage Co., Jackson, Mich.  
 Fuller & Johnson Mfg. Co., 1350 Washington Ave., Madison, Wis.  
 Fulton Mfg. Co., 12th & Cranberry Sts., Erie, Pa.  
 Gade Bros. Mfg. Co., Iowa Falls, Ia.  
 Gibbs Gas Engine Co. of Florida, 26 S. Main St., Jacksonville, Fla.  
 Hall-Scott Motor Car Co., Inc., Crocker Bldg., San Francisco, Cal.  
 Hercules Motor Mfg. Co., Canton, O.  
 Hettinger Engine Co., Bridgetown, N. J.  
 Ideal Engine Co., Lansing, Mich.  
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 Kahlenberg Bros. Co., Two Rivers, Wis.  
 LaZier Gas Engine Co., Buffalo, N. Y.  
 Lennox Machine Co., 2558 W. 16th St., Chicago, Ill.  
 Lunt-Moss Co., 43 S. Market St., Boston, Mass.  
 McKeen Motor Car Co., 1222 Webster St., Omaha, Neb.  
 Myrick Machine Co., Olean, N. Y.  
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 Ohio Motor Co., Sandusky, Ohio  
 Olin Gas Engine Co., 10 Lock St., Buffalo, N. Y.  
 Olmstead & Sons, A. E., Pulaski, N. Y.  
 Otto Engine Mfg. Co., 33rd St. & Walnut St., Philadelphia, Pa.  
 Ottumwa-Moline Engine & Pump Co., Ottumwa, Ia.  
 Pittsburgh Model Engine Co., Homewood, Pa.  
 Portsmouth Engine Co., Portsmouth, O.

Regal Gasoline Engine Co., Coldwater, Mich.  
 Reliance Engineering Co. (Olds), Lansing, Mich.  
 Rider-Ericsson Engine Co., 20 Murray St., New York  
 Root & Van Dervoort Engineering Co., East Moline, Ill.  
 Schramm & Son, Inc., Chris. D., 709 Arch St., Philadelphia, Pa.  
 Standard Gas Engine Co., East Oakland, Cal.  
 Steiner & Co., M., 242 Torrence St., Dayton, O.  
 Stickney Co., Charles A., St. Paul, Minn.  
 Stover Mfg. & Engine Co., Freeport, Ill.  
 \*STURTEVANT CO., B. F., Hyde Park, Boston, Mass... *pp. 90, 91*  
 Superior Gas Engine Co., Springfield, O.  
 Teetor-Hartley Motor Corp'n, Hagerstown, Ind.  
 Termaat & Monahan Mfg. Co., Oshkosh, Wis.  
 Union Gas Engine Co., Oakland, Cal.  
 Waterloo Gasoline Engine Co., Waterloo, Ia.  
 Weber Engine Co., Kansas City, Mo.  
 \*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa... *pp. 128, 129*  
 Witte Engine Works, Kansas City, Mo.  
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 Wright Machine Co., Owensboro, Ky.

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 Buffalo Contractors Plant Corp'n, 129 Erie St., Buffalo, N. Y.  
 Buffalo Hoist & Derrick Co., 129 Erie St., Buffalo, N. Y.  
 Chase Machine Co., 2313 Elm St., N. W., Cleveland, O.  
 \*CLYDE IRON WORKS, 29th Ave., W., & Michigan St., Duluth, Minn... *p. 378*  
 Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.  
 Crawford & McCrimmon Co., Brazil, Ind.  
 Dake Engine Co., Grand Haven, Mich.  
 Erie Hoist Co., 2101 Holland St., Erie, Pa.  
 Exeter Machine Works, Pittston, Pa.  
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 Lambert Hoisting Engine Co., 115 Poinier St., Newark, N. J.  
 Lausen-Lawton Co., DePere, Wis.  
 \*LIDGERWOOD MFG. CO., 96 Liberty St., New York... *p. 381*  
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 Milholland Co., J. & J. B., 718 Fifth Ave., Pittsburgh, Pa.  
 NORDBERG MFG. CO., Milwaukee, Wis... *p. 7*  
 Orr & Sembower, Inc., Reading, Pa.  
 Ottumwa Iron Works, Ottumwa, Ia.  
 Shannon & Co., J. Jacob, 1744 Market St., Philadelphia, Pa.  
 Thomas Elevator Co., 22 South Hoyne Ave., Chicago, Ill.  
 Vulcan Iron Works, Wilkes-Barre, Pa.  
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 American-Blakeslee Mfg. Co., Birmingham, Ala.  
 Armstrong Mfg. Co., Waterloo, Ia.  
 Baltimore Oil Engine Co., P. O. B. 100, Highlandtown, Baltimore, Md.  
 Benninghofen Sons, C., Hamilton, O.  
 Brownwall Engine & Pulley Co., 12 W. 4th St., Holland, Mich.

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Burlingame, S. F., W. Boylston St., Worcester, Mass.  
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 Fuller & Johnson Mfg. Co., 1350 E. Washington Ave., Madison, Wis.  
 Fulton Mfg. Co., Erie, Pa.  
 Gade Bros. Mfg. Co., Iowa Falls, Ia.  
 Lausen-Lawton Co., DePere, Wis.  
 Lauson Mfg. Co., John, New Holstein, Wis.  
 Lennox Machine Co., 2558 W. 16th St., Chicago, Ill.  
 Middletown Machine Co., Middletown, O.  
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 Remington Oil Engine Co., Stamford, Conn.  
 Standard Oil Engine Co., 130 Seaview Ave., Bridgeport, Conn.  
 Steiner & Co., M., 242 Torrence St., Dayton, O.  
 Strang Engine Co., Harvey, Ill.  
 Termaat & Monahan Mfg. Co., Oshkosh, Wis.  
 Union Gas Engine Co., Oakland, Cal.  
 United Engine Co., Lansing, Mich.  
 Weber Engine Co., Kansas City, Mo.  
 Wolverine Motor Works, Bridgeport, Conn.  
 Wright Machine Co., Owensboro, Ky.  
 —**Marine**  
 American Engine Co., 2nd & Amsterdam Ave., Detroit, Mich.  
 American Whaley Engine Co., 136 Federal St., Boston, Mass.  
 Anderson Engine Co., 4036 N. Rockwell St., Chicago, Ill.  
 BADENHAUSEN & CO., 1425 Chestnut St., Philadelphia, Pa...*pp. 44, 45*  
 Bay State Iron Works, Erie, Pa.  
 Bolinders Co., 30 Church St., New York  
 Boston Engineering Co., India Wharf, Boston, Mass.  
 Bryant Co., 1025 South Menard Ave., Chicago, Ill.  
 Buffalo Gasoline Motor Co., 1280-1290 Niagara St., Buffalo, N. Y.  
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 Carbone & Co., A., 114 Centre St., New York  
 Clay Engine Co., 6950 Kinsman Road, Cleveland, O.  
 Craig Engine & Machine Works, James, 807 Garfield Ave., Jersey City, N. J.  
 Evansville Gas Engine Works, 1230 Riverside Ave., Evansville, Ind.  
 FAIRBANKS, MORSE, & CO., 920 Wabash Ave., Chicago, Ill...*p. 599*  
 Fay & Bowen Engine Co., Geneva, N. Y.  
 Ferro Machine & Foundry Co., Cleveland, O.  
 Gas Engine & Power Co., and Charles L. Seabury & Co., Cons., Morris Heights, New York  
 Great Lakes Engineering Works, Detroit, Mich.  
 Hall Gas Engine Co., Bridesburg, Philadelphia, Pa.  
 Hooven-Owens-Rentschler Co., Hamilton, Ohio.  
 Inglis, Co., Ltd., John, Toronto, Ont., Canada  
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 Kahlenberg Bros. Co., Two Rivers, Wis.  
 Kearfoot Engineering Co., Inc., 95 Liberty St., New York City  
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 Mietz Corp., August, 128 Mott St., New York

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 Page Engineering Co., Foot Latrobe Park, Baltimore, Md.  
 Providence Engineering Corp'n, Providence, R. I.  
 Rees & Sons Co., James, Pittsburgh, Pa.  
 Regal Gasoline Engine Co., Coldwater, Mich.  
 Roberts Motor Mfg. Co., Sandusky, O.  
 Standard Fuel Oil Engine Co., Willoughby, O.  
 Standard Gas Engine Co., East Oakland, Cal.  
 Strang Engine Co., Harvey, Ill.  
 Sun Shipbuilding Co., Chester, Pa.  
 Tampa Shipbuilding & Engineering Co., Tampa, Fla.  
 Union Gas Engine Co., Oakland, Cal.  
 Universal Motor Co., Oshkosh, Wis.  
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 —**Oil**  
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 Bessemer Gas Engine Co., Grove City, Pa.  
 Bolinders Co., 30 Church St., New York  
 Buckeye Machine Co., Lima, O.  
 Burnoil Engine Co., Mishawaka, Ind.  
 Butler Engine & Foundry Co., Butler, Pa.  
 Castle Engineering Co., Inc., A. M., La Crosse, Wis.  
 Charter Gas Engine Co., Sterling, Ill.  
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 International Harvester Co. of America, Harvester Bldg., Chicago, Ill.  
 Jacobson Engineering Co., Albany, N. Y.  
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 Pittsburgh Filter U Engineering Co., 614 Farmers Bank Building, Pittsburgh, Pa.  
 Power Mfg. Co. (Primm), Cheney Ave., Marion, O.  
 Price Pump & Engine Co., G. W., 33 Stevenson St., San Francisco, Cal.  
 Rathbun Jones Engineering Co., Toledo, O.  
 Reid Gas Engine Co., Joseph, Oil City, Pa.  
 Reliable Engine Co. (Reliable), Portsmouth, O.  
 Remington Oil Engine Co., Stamford, Conn.  
 Standard Fuel Oil Engine Co., Willoughby, O.  
 Standard Oil Engine Co., 130 Seaview Ave., Bridgeport, Conn.  
 Stover Mfg. & Eng. Co., Freeport, Ill.  
 Superior Gas Engine Co., Springfield, O.

Turner-Fricke Mfg. Co., Pittsburgh, Pa.  
 Union Tool Co., Torrance, Cal.  
 Weber Engine Co., Kansas City, Mo.  
 Weiss Engine Co., 17 Battery Place, New York  
 Western Machinery Co., 900 N. Main St., Los Angeles, Cal.  
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 Western Machinery Co., 900 N. Main St., Los Angeles, Cal.

—**Oil, Semi-Diesel**  
 Power Mfg. Co. (Primm), Cheney Ave., Marion, O.

—**Pumping**  
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 American Well Works, Aurora, Ill.  
 Augustine Automatic Rotary Engine Co., 1862 Elmwood Ave., Buffalo, N. Y.  
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 American & British Mfg. Co., Bridgeport, Conn.  
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 Bryant Co., 1025 South Menard Ave., Chicago, Ill.  
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 Lawrence Machine Co., Lawrence, Mass.  
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 Lucey Mfg. Corp'n, Woolworth Bldg., New York  
 Machold & Riddell, 1020 Stephen Girard Bldg., Philadelphia, Pa.  
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 Providence Engineering Corp. (Rice & Sargent), Providence, R. I.  
 Randle Machinery Co., Cincinnati, O.  
 Ridgway Dynamo & Engine Co., Ridgway, Pa.  
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 Chandler & Taylor Co., Indianapolis, Ind.  
 Chuse Engine & Mfg. Co., Mattoon, Ill.  
 Clark Bros. Co., Olean, N. Y.  
 Cooper Co., C. & G., Mt. Vernon, O.  
 Filer & Stowell Co., Milwaukee, Wis.  
 Franklin Machine Co. (Harris), 189 Charles Sts., Providence, R. I.  
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 Granger Co., A. D., 15 Park Row, New York  
 Hardie-Tynes Mfg. Co., 8th Ave. & 28th St., Birmingham, Ala.  
 Hewes & Phillips Iron Works, Newark, N. J.  
 Hooven, Owens, Rentschler Co., Hamilton, O.  
 Ide & Sons, A. L., Springfield, Ill.  
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 Waterloo Gasoline Engine Co., Waterloo, Ia.

**ENGRAVING MACHINES**  
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 Schmidt Co., F. L., 150 11th Ave., New York

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 Coal Preparing  
 Flue Shop  
 Foundry  
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Columbus Iron Works Co., 50 Broad St., New York

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Hercules Engineering Corp'n, 501 Fifth Ave., New York

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Louisville Drying Machinery Co., 451 Baxter Ave., Louisville, Ky.

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Charter Gas Engine Co., Sterling, Ill.

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Gade Bros. Mfg. Co., Iowa Falls, Ia.

Hayward Co., 50 Church St., New York

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\*LIDGERWOOD MFG. CO., 96 Liberty St., New York... *p. 381*

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Monaghan Machine Co., 2024 Carroll Ave., Chicago, Ill.

Pawling & Harnischfeger Co., Milwaukee, Wis.

Potter Mfg. Co., 3511 E. Washington St., Indianapolis, Ind.

Sauerman Bros., 1141 Monadnock Block, Chicago, Ill.

Thew Automatic Shovel Co., Lorain, O.

Toledo Foundry & Machine Co., Toledo, O.

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Cyclone Blow Pipe Co., 2552 W. 21st. St., Chicago, Ill.

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 \*GENERAL ELECTRIC CO., Schenectady, N. Y. . . *pp. 16-25 inc.*

\*GREEN FUEL ECONOMIZER CO., 90 West St., New York. . . *p. 74*

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 Henderer's Sons, A. L., Wilmington, Del.  
 Nicholson & Co., W. H., Wilkes-Barre, Pa.

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 Hart & Co., Inc., Frederick, 837 Main St., Poughkeepsie, N. Y.

Maintenance Co., 417-421 Canal St., New York, N. Y.

\*PRECISION INSTRUMENT CO., Detroit, Mich. . . *pp. 240, 241*

Weiss, Louis T., 286 Taaffe Place, Brooklyn, N. Y.  
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 Luther Mfg. Co., Olean, N. Y.

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Sanborn Evaporator Co., 50 Broad St., New York

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National Separator & Machine Co., 89 State St., Boston, Mass.

Oleite Corp'n, 95 William St., New York

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Backus Water Motor Co., 172-182 Pennsylvania Ave., Newark, N. J.

Barney Ventilating Fan Works, 25 Haverhill St., Boston, Mass.

Buckeye Blower Co., Columbus, O.

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

Clarage Fan Co., Kalamazoo, Mich.

Cleveland Blow Pipe & Mfg. Co., 6302 Kinsman Road, Cleveland, O.

Colonial Fan & Motor Co., Warren, O.

COPPUS ENGINEERING & EQUIPMENT CO., Worcester, Mass. . . *pp. 86, 87*

Cyclone Blow Pipe Co., 2552 W. 21st St., Chicago, Ill.

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Eck Dynamo & Motor Co., Belleville, N. J.

Electric Blower Co., 352 Atlantic Ave., Boston, Mass.

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Howard & Morse, 45 Fulton St., New York

Hun Berry Fan Co., A., 28 Binford St., Boston, Mass.

Indiana Fan Co., 40 E. South St., Indianapolis, Ind.

Kemble Electric Co., 634 N. Western Ave., Chicago, Ill.



Meadon's Blower & Pipe Works, 23-27 Messer-  
ole Ave., Brooklyn, N. Y.  
Mechanical Appliance Co., Milwaukee, Wis.  
National Blow Pipe Mfg. Co., 738 Dryades St.,  
New Orleans, La.  
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\*STURTEVANT CO., B. F., Hyde Park, Bos-  
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Seattle, Wash.  
\*WESTINGHOUSE ELECTRIC & MFG. CO.,  
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## FAUCETS, TANK WAGON

Cleveland Brass Mfg. Co., 606 Hamilton Ave.,  
Cleveland, O.

FEED WATER CIRCULATORS, HEATERS,  
REGULATORS, ETC.

(See Circulators, Heaters, Regulators, etc., Feed  
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FEED WATER HEATERS AND PURIFIERS  
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Booth Felt Co., Inc., 440-450 14th St., Brook-  
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## FERRO-MOLYBDENUM

Tungsten Products Co. of Maryland, Baltimore,  
Md.

## FERRO-TITANIUM

Tungsten Products Co. of Maryland, Baltimore,  
Md.

## FERRO-TUNGSTEN

Tungsten Products Co. of Maryland, Baltimore,  
Md.

Vanadium-Alloys Steel Co., Latrobe, Pa.

## FERRO-URANIUM

Standard Alloys Co., Forbes & Meyran Aves.,  
Pittsburgh, Pa.

## FERRO-VANADIUM

Standard Alloys Co., Forbes & Meyran Aves.,  
Pittsburgh, Pa.

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TORRINGTON MFG. CO., Torrington, Conn.  
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Pullman Ventilator & Mfg. Co., West York Ave.  
& W. M. R. R., York, Pa.

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**FIBRE MAKING MACHINERY**

Freese & Co., E. M., Galion, O.

**FILE SHARPENING MACHINES**

Abrasive Machine Co., Irvington, N. J.

**FILES**

ATKINS & CO., E. C., Indianapolis, Ind...*p. 512*

Delta File Works (Delta), 3227 Frankford Ave., Philadelphia, Pa.

Hayes File Co., Detroit, Mich.

Nicholson File Co., Providence, R. I.

Simonds Mfg. Co., Fitchburg, Mass.

Walls Tool & Supply Co., T. P. (Valeau), 75-77 Walker St., New York

**FILING AND HACKSAW MACHINES (Combined)**

Extensive Mfg. Co., 90 West St., New York

**FILING MACHINES**

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Extensive Mfg. Co., 90 West St., New York  
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Oliver Instrument Co., Adrian, Mich.  
Rearwin, W. D., 341 Mill Ave., Grand Rapids, Mich.

Robinson Tool Works, Inc., Waterbury, Conn.

**FILLER, IRON AND STEEL**

Clark Cast Steel Cement Co., Shelton, Conn.

**FILLETS, LEATHER**

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Nightingale & Childs Co., 205 Congress St., Boston, Mass.

**FILTERS****—Beer and Wine**

Loew Mfg. Co., 9100 Mouson Ave., Cleveland, O.

**—Chemical Solution**

DEVINE CO., J. P., Buffalo, N. Y...*pp. 626, 627*

United Filters Corp'n, 36 Flatbush Ave. Extension, Brooklyn, N. Y.

United Filters Corp'n, 65 Broadway, New York

**—Gravity**

BRAUN & CO., C. F., 503 Market St., San Francisco, Cal...*p. 602*

Permutit Co., 440 Fourth Ave., New York  
Power Plant Specialty Co. (Vater), 1306 Monadnock Block, Chicago, Ill.

Roberts Filter Mfg. Co., Darby, Pa.

\*SCAIFE & SONS CO., WM. B., Pittsburgh, Pa...*pp. 122, 675*

**—Oil**

Andrews, Inc., William, 120 Liberty St., New York

Bonar & Co., James, 502 Park Bldg., Pittsburgh, Pa.

Bousman Mfg. Co., 1153-57 Plainfield Ave., N. E., Grand Rapids, Mich.

Burt Mfg. Co., Akron, O.

Famous Filter Co., 118 Pine St., St. Louis, Mo.

Flower & Co., Walter L., 312-314 S. 8th St., St. Louis, Mo.

KOVEN & BROTHER, L. O., 154 Ogden Ave., Jersey City, N. J...*p. 628*

Liberty Mfg. Co., 6900 Susquehanna St., Pittsburgh, Pa.

Nugent & Co., Wm. W., 146-148 W. Superior St., Chicago, Ill.

OLEITE CORP'N, 120 Liberty St., 95 William St., New York

OIL & WASTE SAVING MACHINE CO., 1509 Real Estate Trust Bldg., Philadelphia, Pa...*p. 642*

Pittsburgh Gage & Supply Co., Pittsburgh, Pa.  
Power Plant Specialties, 219 Ruffner St., Lockland, O.

\*RICHARDSON-PHENIX CO., 126 Reservoir Ave., Milwaukee, Wis...*pp. 206, 207, 208, 209*  
Robertson Co., John F., 1001 Park Bldg., Pittsburgh, Pa.

Sims Co., Erie, Pa.

Turner Oil Filter Co., Niles, Mich.

**—Oil (Centrifugal)**

\*DE LAVAL STEAM TURBINE CO., 580 Jackson Ave., Trenton, N. J...*p. 15*

OIL & WASTE SAVING MACHINE CO., 1509 Real Estate Trust Bldg., Philadelphia, Pa...*p. 642*

**—Pressure**

BRAUN & CO., C. F., 503 Market St., San Francisco, Cal...*p. 602*

Permutit Co., 440 Fourth Ave., New York  
Power Plant Specialty Co. (Vater), 1306 Monadnock Block, Chicago, Ill.

Roberts Filter Mfg. Co., Darby, Pa.

\*SCAIFE & SONS CO., WM. B., Pittsburgh, Pa...*pp. 122, 675*

**—Water**

American Water Softener Co., 1011 Chestnut St., Philadelphia, Pa.

\*CASEY-HEDGES CO., Chattanooga, Tenn...*pp. 48, 49*

Detroit Steam Appliance Co., 500 Union Trust Bldg., Detroit, Mich.

Elliott Co., Frick Bldg., Pittsburgh, Pa.

Glamorgan Pipe & Foundry Co., Lynchburg, Va.

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Greer Chemical Co., Chicago, Ill.

Hygeia Filter Co., 338 Denton Ave., Detroit, Mich.

International Filter Co., 40 S. Dearborn St., Chicago, Ill.

Lagonda Mfg. Co., Springfield, O.

Loomis-Manning Filter Distributing Co., 1421 S. 37th St., Philadelphia, Pa.

New York Continental Jewell Filtration Co., 15 Broad St., New York

Richmond Water Softener Co., Richmond, Ind.

Roberts Filter Mfg. Co., Darby, Pa.

Ross Valve Mfg. Co., Troy, N. Y.

\*SCAIFE & SONS CO., WM. B., Pittsburgh, Pa...*pp. 122, 675*

\*SCHUTTE & KOERTING CO., 1184 Thompson St., Philadelphia, Pa...*pp. 160, 161*

Watson, N. A., 2016 State St., Erie, Pa.

**FILTRATION PLANTS**

International Filter Co., 40 S. Dearborn St., Chicago, Ill.

Loomis-Manning Filter Distributing Co., 1421 S. 37th St., Philadelphia, Pa.

New York Continental Jewell Filtration Co., 15 Broad St., New York

Norwood Engineering Co., Florence, Mass.

Power Plant Specialty Co. (Vater), 1306 Monadnock Block, Chicago, Ill.

Reisert Automatic Water Purifying Co., 23 E. 26th St., New York

Roberts Filter Mfg. Co., Darby, Pa.

\*SCAIFE & SONS CO., WM. B., Pittsburgh, Pa...*pp. 122, 675*

**—Municipal**

Roberts Filter Mfg. Co., Darby, Pa.

**FIRE BRICK, HYDRANTS, SAND, ETC.**  
(See Brick, Hydrants, Sand, Etc., Fire)

**FIRE DEPARTMENT SUPPLIES**

American-La France Fire Engine Co., Inc., Elmira, N. Y.

Barnes Co., Henry K., 234 Devonshire St., Boston, Mass.

Consumers Rubber Co., 829 Superior Ave., Cleveland, O.  
Morse & Son, Inc., Andrew J., 221 High St., Boston, Mass.

**FIRE DOOR FIXTURES (Automatic)**

Automatic Sprinkler Co. of America, 123 William St., New York

COBURN TROLLEY TRACK MFG. CO., Holyoke, Mass... *p.* 374

Wagner Mfg. Co., Cedar Falls, Ia.

**FIRE DOORS (Locomotive, Automatic)**

Franklin Railway Supply Co., 30 Church St., New York

**FIRE EXTINGUISHERS**

American-La France Fire Engine Co., Inc., Elmira, N. Y.

Automatic Sprinkler Co. of America, 123 William St., New York

\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p.* 200

**FIRE HOSE MACHINERY**

Royle & Sons, John, Paterson, N. J.

**FIRE TUBE BOILERS**

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**FITTINGS****—Acid**

Duriron Castings Co., Dayton, O.

Eastwood Wire Mfg. Co., Belleville, N. J.

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**—Ammonia**

Baker Ice Machine Co., Omaha, Neb.

\*DE LA VERGNE MACHINE CO., 1123 E. 138th St., New York... *p.* 33

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\*RICHARDSON-PHENIX CO., 126 Reservoir Ave., Milwaukee, Wis... *pp.* 206, 207, 208, 209

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Carthage Machine Co., Carthage, N. Y.

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CLOW & SONS, JAMES B., 534-36 S. Franklin St., Chicago, Ill... *pp.* 188, 189

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Red Wing Iron Works, Red Wing, Minn.

SIMMONS CO., JOHN, 110 Center St., New York... *p.* 229

Stockham Pipe & Fittings Co., Birmingham, Ala.

\*UNITED STATES CAST IRON PIPE & FDRY. CO., Burlington, N. J... *p.* 191

West Coast Iron Works, 4609 14th Ave., Seattle, Wash.

**—Flanged**

American Car & Foundry Co., 165 Broadway, New York

Central Station Steam Co., 710 E. Woodbridge St., Detroit, Mich.

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Direct Separator Co., Syracuse, N. Y.

EDWARD VALVE & MFG. CO., 72 W. Adams St., Chicago, Ill... *p.* 143

Essex Foundry, Murray St. & Avenue D., Newark, N. J.

General Fire Extinguisher Co., 277 W. Exchange St., Providence, R. I.

ILLINOIS MALLEABLE IRON CO., 1801-25 Diversey Parkway, Chicago, Ill... *p.* 196

Lambert & Co., Geo. B., 570 Fulton St., Chicago, Ill.

Lumsden & Van Stone Co., 426 First St., South Boston, Mass.

LYNCHBURG FOUNDRY CO., Lynchburg, Pa... *p.* 190

Massillon Iron & Steel Co., Massillon, O.

\*PITTSBURGH VALVE, FOUNDRY & CONST. CO., Pittsburgh, Pa... *pp.* 156, 157

Reading Valve & Fittings Co., Reading, Pa.

Shaw-Kendall Engineering Co., 120-130 So. Superior St., Toledo, O.

SIMMONS CO., JOHN, 110 Center St., New York... *p.* 229

Stockham Pipe & Fittings Co., Birmingham, Ala.

Thompson & Co., J., Van Horn & Sophia Sts., Philadelphia, Pa.

\*UNITED STATES CAST IRON PIPE & FDRY. CO., Burlington, N. J... *p.* 191

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Pittsburgh Piping & Equipment Co., 35th & Charlotte Sts., Pittsburgh, Pa.

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High Pressure Fitting & Valve Co., 72-74 Putnam St., Paterson, N. J.

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Detroit Brass Works, 99 Hobart Ave., Detroit, Mich.

Donaldson Iron Co., Emaus, Lehigh Co., Pa.

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Jefferson Union Co., Lexington, Mass.

KELLY & JONES CO., Greensburg, Pa... *pp.* 150, 151

Krahn Mfg. Co., 590 Clinton St., Milwaukee, Wis.

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McMann & Taylor Co., 104-106 John St., New York

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McRae & Roberts Co., 211 Campbell Ave., Detroit, Mich.

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Pittsburgh Valve & Fittings Co., Barberton, O.

\*PITTSBURGH VALVE, FOUNDRY & CONST. CO., Pittsburgh, Pa... *pp.* 156, 157

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Standard Cast Iron Pipe & Foundry Co., Bristol, Pa.

Stockham Pipe & Fittings Co., Birmingham, Ala.

Stoddard Union Co., Lockport, N. Y.

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Walworth Mfg. Co., First & O Sts., South Boston, Mass.

Wilfert Co., John, 258 Broadway, New York

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Bard Union Co., Inc., Norwich, Conn.

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Ballwood Co., 30 Church St., New York

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Philadelphia Steel & Iron Co., 1008 Commercial Trust Bldg., Philadelphia, Pa.

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Scully Steel & Iron Co., P. O. Box 814, Chicago, Ill.

Standard Spiral Pipe Works, 4801 S. Rockwell St., Chicago, Ill.

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**FLEXIBLE SHAFT OUTFITS**

(Portable) Plank Flexible Shaft Machine Co., Grand Rapids, Mich.

**FLOATS, COPPER**

Consolidated Mfg. Co., 28 N. Canal St., Dayton, O.

Harris & Co., Arthur, 212 Curtis St., Chicago, Ill.  
Hercules Float Works (Hercules), 200 Franklin St., Springfield, Mass.

MARK MFG. CO., P. O. Box G, Chicago, Ill.  
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Reliance Gauge Column Co. (Reliance), 5902 Carnegie Ave., Cleveland, O.  
Roberts Steam Specialty Co., 5318 St. Clair Ave., Cleveland, O.

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Trus-Con Laboratories, Cor. Cauliff & G. T. A. A., Detroit, Mich.

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Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa.

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**—Block (Wood)**

Jennison-Wright Co. (Kreolite), 2463 Broadway, Toledo, O.

Pittsburgh Wood Preserving Co., 1053 Century Bldg., Pittsburgh, Pa.

Wyckoff Pipe & Creosoting Co., 30 E. 42nd St., New York

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Underwood Corp., H. B., 1025 Hamilton St., Philadelphia, Pa.

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**FLUE SHOP EQUIPMENT**

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 General Drop Forge Co., 1738 Elmwood Ave.,  
 Buffalo, N. Y.  
 Heppenstall Forge & Knife Co., Pittsburgh, Pa.  
 International High Speed Steel Co., Rockaway,  
 N. J.  
 Jersey Forging Wks., 16th St. & Jersey Ave.,  
 Jersey City, N. J.  
 Liggett Spring & Axle Co., Monongahela, Pa.  
 Michigan Bolt & Nut Works, Detroit, Mich.  
 Midvale Steel & Ordnance Co., Widener Bldg.,  
 Philadelphia, Pa.  
 National Lock Washer Co., Newark, N. J.  
 Steel Forgings Co., Brotherton Rd., Cincinnati,  
 O.

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Ingalls-Shepard Forging Co., Harvey, Ill.

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 side Ave., Cleveland, O.  
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Henry & Allen, Auburn, N. Y.

Ingalls-Shepard Forging Co., Harvey, Ill.

Keystone Drop Forge Works, Chester, Pa.

Kraeuter & Co., Inc., 585 18th Ave., Newark,  
 N. J.

Ladish Drop Forge Co., Cudahy, Wis.

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Standard Spiral Pipe Works, 4801 S. Rockwell  
 St., Chicago, Ill.

Steel Car Forge Co., Frick Bldg., Pittsburgh, Pa.

Transue & Williams Steel & Forging Corp'n,  
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Union Drop Forge Co., 358 W. Grand Ave.,  
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Universal Machine Co., Bowling Green, O.

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**WILLIAMS & CO., J. H.**, 70 Richards St.,  
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Erie Forge Co., Erie, Pa.

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Steel Forgings Co., Bootherton Road, Cincinnati,  
 O.

Tioga Steel & Iron Co., 52nd & Gray's Ave.,  
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**\*BAYONNE CASTING CO.**, Bayonne, N. J.

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Dyson & Son, Joseph, 5125 St. Clair Ave., Cleve-  
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Elyria Machine Co., Elyria, O.

**—Hydraulic**

Bethlehem Steel Co., Bethlehem, Pa.

**—Ice Makers**

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**—Iron and Steel**

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Camden Forge Co., Mt. Ephraim Ave., Cam-  
 den, N. J.

Cann & Saul Steel Co., 516 Commerce St.,  
 Philadelphia, Pa.

Carbon Steel Co., P. O. Box 1591, Pittsburgh,  
 Pa.

Cleveland City Forge & Iron Co., 45th St. &  
 Lakeside Ave., Cleveland, O.

Crucible Steel Forge Co., 6607 Grant Ave.,  
 Cleveland, O.

Gale Mfg. Co., Albion, Mich.

Hay-Budden Mfg. Co., 254 N. Henry St.,  
 Brooklyn, N. Y.

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McDougall & Potter Co., 606-612 W. 55th St.,  
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 Trust Bldg., Philadelphia, Pa.

Pittsburgh Forge & Iron Co., 1003 Penn Ave.,  
 Pittsburgh, Pa.

Pollak Steel Co., Cincinnati, O.

Reading Iron Co., Reading, Pa.

Standard Steel Works Co., Morris Bldg., Phila-  
 delphia, Pa.

Steel Car Forge Co., Frick Bldg., Pittsburgh, Pa.

Strait Mfg. Co., H. N., Kansas City, Mo.

Tindel-Morris Co., Eddystone, Pa.

Wharton, Jr., & Co., Inc., Wm., P. O. Box 124,  
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**WILLIAMS & CO., J. H.**, 70 Richards St.,  
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Berkshire Mfg. Co., Cleveland, O.

Central Foundry Supply Co., P. O. Box 495,  
Columbus, O.

Champion Foundry & Mach. Co., 2419 W. 14th  
St., Chicago, Ill.

Cleveland Osborn Mfg. Co., 5401 Hamilton Ave.,  
Cleveland, O.

Dayton Molding Machine Co., Dayton, O.

Federal Foundry Supply Co., Cleveland, O.

Grimes Molding Machine Co., 1218 Hastings  
St., Detroit, Mich.

Hill & Griffith Co., 1262 State Ave., Cincinnati,  
O.

Mott Sand Blast Mfg. Co., Inc., 2-8 Frost St.,  
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Northern Crane Works, Ltd., Walkerville, Ont.,  
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\*NORTHERN ENGINEERING WORKS, De-  
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Standard Sand & Machine Co., Cleveland, O.

Tessmer Machine & Tool Co., 285-91 Rivard St.,  
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Obermayer Co., S., Cincinnati, O.

Paxson Co., J. W., 1021 N. Delaware Ave.,  
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Turner, Vaughn & Taylor Co., Cuyahoga Falls,  
O.

**—Worsted Drawing**

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Scott, C. U., 1510 1st Ave., Rock Island, Ill.

Standard Fuel Engineering Co., 73-77 Balti-  
more Ave., W., Detroit, Mich.

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McAleenan Brothers Co., 25th & R. R. Sts.,  
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Mohr & Sons, John, 349-359 W. Illinois St.,  
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—**Coal Burning**

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Greene Process Metal Co., 1602 Hoge Bldg., Seattle, Wash.

Hamilton & Hansell, Inc., 13-21 Park Row, New York

Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. R. Ave., Newark, N. J.

Morris Engineering Co., 39 Cortlandt St., New York

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Pyroelectric Instrument Co. (Northrup-Ajax), 636-640 East State St., Trenton, N. J.

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Chicago Flexible Shaft Co., 579 LaSalle Ave., Chicago, Ill.

Ferguson Furnace Co., 1206 Second Nat'l Bank Bldg., Toledo, O.

Flinn & Drefflein Co., 431 S. Dearborn St., Chicago, Ill.

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National Gas Furnace Co., 9 Codding St., Providence, R. I.

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Schwab, Gustav, 525 Market St., San Francisco, Cal.

Standard Fuel Engineering Co., 73-77 Baltimore Ave., W., Detroit, Mich.

Surface Combustion Co., 366-368 Gerard Ave., New York

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Granger Co., A. D. (Schwartz), 15 Park Row,  
 New York

Greene Process Metal Co., 1602 Hoge Bldg.,  
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Production Engineering Co., 1716 Spring Garden  
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Amsler Gas Power Co., Wabash Bldg., Pittsburgh, Pa.

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Gleason Works, 1030 University Ave., Rochester, N. Y.  
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Cincinnati Gear Co., 1825 Reading Road, Cincinnati, O.

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Albaugh-Dover Co., 2100 Marshall Blvd., Chicago, Ill.

American Die & Tool Co., 2nd & Buttonwood Sts., Reading, Pa.

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Cross Gear & Engine Co., 800-806 Bellevue Ave., Detroit, Mich.

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Earle Gear & Machine Co., Stenton & Wyoming Aves., Wayne Junction, Philadelphia, Pa.

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Foote Bros. Gear & Machine Co., 213 N. Curtis St., Chicago, Ill.

Gleason Works, 1030 University Ave., Rochester, N. Y.

Grant Gear Works, 151 Pearl St., Boston, Mass.

Grant-Lees Gear Co., 2367 E. 69th St., Cleveland, O.

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Meisselbach-Catucci Mfg. Co., 24 Congress St., Newark, N. J.

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New Process Gear Corp'n, Syracuse, N. Y.

New York Gear Works, 56 Greenpoint Ave., Brooklyn, N. Y.

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Sommerfield Machine & Mfg. Co., 220 2nd Ave., Pittsburgh, Pa.

Spacke Machine & Tool Co., Indianapolis, Ind.

Stahl Gear & Machine Co., 1390 E. 40th St., Cleveland, O.

Tool Steel Gear & Pinion Co., Station P, Cincinnati, O.

Turley Gear & Machine Co., 1505 N. 10th St., St. Louis, Mo.

Union Gear & Machine Co., 27 Purchase St., Boston, Mass.

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Woburn Gear Works, Woburn, Mass.

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Electro-magnetic Tool Co., 2902 Carroll Ave., Chicago, Ill.

Forbes & Myers, 172 Union St., Worcester, Mass.

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Universal Grinding Machine Co., Fitchburg, Mass.

Valley City Machine Works, 12-16 Campau Ave., Grand Rapids, Mich.

Walker Co., O. S., Worcester, Mass.

Wilmarth & Morman Co., 2100 Monroe Ave., Grand Rapids, Mich.

Woods Engineering Co., 108 Patterson St., Alliance, O.

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Chicago Wheel & Mfg. Co., 1101-1103 W. Monroe St., Chicago, Ill.

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Peninsular Grinding Wheel Co., 253 Meldrum Ave., Detroit, Mich.

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 —**Bolt (Hand)**  
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 Ballwood Co., 30 Church St., New York  
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—**Feed Water (Closed)**

- Alberger Heater Co., Chicago & Granger Sts., Buffalo, N. Y.

- Alberger Pump & Condenser Co. (Wainwright), 140 Cedar St., New York  
 Baragwanath & Son, Wm., 1633 Monadnock Block, Chicago, Ill.

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 Consolidated Engineering Co., 335 W. 28th Pl., Chicago, Ill.  
 Garden City Fan Co., McCormick Bldg., Chicago, Ill.  
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—**Exhaust Steam**

American District Steam Co., North Tonawanda, N. Y.

Tyler Underground Heating System, 815 S. Canal St., N. S., Pittsburgh, Pa.

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Borromite Co. of America, 1509 Standard Trust Bldg., Chicago, Ill.

Consolidated Engineering Co., 335 W. 28th Pl., Chicago, Ill.

Donnelly Systems Co., 9 Murray St., New York

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Webster & Co., Warren, Point & Pearl Sts., Camden, N. J.

—**Vapor**

Bishop & Babcock Co., E. 49th & Hamilton Ave., Cleveland, O.

**HERRINGBONE GEARS**

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**HICKORY PRODUCTS**

Mintin & Son, T. W., Barboursville, Ky.

**HOBS, THREAD MILLING**

Davidson Tool Mfg. Corp'n, 120-124 Maiden Lane, New York

Gale-Sawyer Co., 36 Oliver St., Boston, Mass.

Illinois Tool Works, 154-168 E. Erie St., Chicago, Ill.

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Albro-Clem Elevator Co., Erie Ave. & D St., Philadelphia, Pa.

Box Iron Works Co., Wm. A., 33rd & Blake Sts., Denver, Colo.

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 Sperry Gyroscope Co., Manhattan Bridge Plaza, Brooklyn, N. Y.  
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 Richards Mfg. Co., Grand Rapids, Mich.  
 Ric-Wil Co., 522 Guardian Bldg., Cleveland, O.  
 Standard Asbestos Mfg. Co., Chicago, Ill.  
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Federal Tool & Alloy Steel Corp'n, Woolworth Bldg., N. Y. C.

**—Pig**

Bethlehem Steel Co., Bethlehem, Pa.  
 Central Iron & Steel Co., Front & Dock Sts., Harrisburg, Pa.

**—Staybolt**

Falls Hollow Staybolt Co., 21 E. Portage St., Cuyahoga Falls, O.  
 Lockhart Iron & Steel Co., Pittsburgh, Pa.  
 Rome Iron Mills, Inc., 30 Church St., New York  
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 Charter Gas Engine Co., Sterling, Ill.  
 Oliver Mfg. Co., Fourth & Madison Sts., Oakland, Cal.

## J

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DeWeese Co., F. M. (Moshu), Chillicothe, O.

**—Hydraulic**

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

Henderer's Sons, A. L., Wilmington, Del.

Joyce-Gridland Co., Dayton, O.

Justice & Co., P. S. (Reliance), 421 Chestnut St., Philadelphia, Pa.

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Buda Co., Railway Exchange Bldg., Chicago, Ill.

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Clayville Foundry & Machine Co., Inc., Clayville, N. Y.

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Justice & Co., P. S., 421 Chestnut St., Philadelphia, Pa.

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**JAPANNING**

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City Machine & Tool Works, 3rd & June Sts., Dayton, Ohio

Columbus Die, Tool & Machine Co., Columbus, O.

Diamant Tool & Mfg. Co., Inc., 91-97 Runyon St., Newark, N. J.

Dodge Tool Co., Grinnell, Ia.

Dove-Smith & Son, Niagara Falls, N. Y.

Electric Co., 94 Allyn St., Hartford, Conn.

Easton Machine Co., Washington St., South Easton, Mass.

Franklin Die & Tool Co., Columbus, O.

Gardam & Son, Inc., Wm., 114 Park Place, New York

Gem City Machine Co., 434 E. First St., Dayton, O.

Goddard Tool Co., 351 W. Chicago Ave., Chicago, Ill.

Hall Gas Engine Co., Bridesburg, Philadelphia, Pa.

Hartford Engine Works, 223 State St., Hartford, Conn.

Hinsman Machine & Tool Co., Elm St., Westfield, Mass.

Holmes Mfg Co., Shelton, Conn.

McCall Machine Works, Rochester, N. Y.

Mantle & Co., 1907 Park Ave., New York

Marvin Mfg. Co., W. B., Urbana, O.

Maute & Sons, J., 23 Kane St., Buffalo, N. Y.

Mehl Machine Tool & Die Co. (Mehl Made), Roselle, N. J.

Meyers Co., W. F., Bedford, Ind.

Modern Mfg. Co., 75 Third St., Bridgeport, Conn.

Production Tool & Engrg. Co., 507 W. Jackson Blvd., Chicago, Ill.

Robbins, Gamwell & Co., 68 West St., Pittsfield, Mass.

Rogers Machine Co., 25 Church St., New York

Sheffield Machine & Tool Co., Dayton, O.

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Walker Bros. Co., 227 Walton St., Syracuse, N. Y.

**JOINTS****—Ball and Swing**

Moran Flexible Steam Joint Co., Inc., 217 West Main St., Louisville, Ky.

Peninsular Milled Screw Co., 1090 Lafayette East, Detroit, Mich.

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Hornung, J. C., 343 S. Dearborn St., Chicago, Ill.

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—**Universal**

Bearings Co. of America (Sterling), 1012 Ford Bldg., Detroit, Mich.

Burt Mfg. Co., Kalamazoo, Mich.

Easton Mach. Co., South Easton, Mass.

Spicer Mfg. Corp'n, South Plainfield, N. J.

Universal Machine Co., Bowling Green, O.

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Sowers Mfg. Co., 1300 Niagara St., Buffalo, N. Y.

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Columbia Nut & Bolt Co., Inc. (Simplicity), Bridgeport, Conn.

Dyett Co., Frank J., 73 John St., Iliion, N. Y.

Latshaw Steel & Metal Products Corp'n, Spring City, Pa.

Leard, Co., Wm. E., 16th St. & 5th Ave., New York

Moltrup Steel Products Co., Beaver Falls, Pa.

Morton Mfg. Co., Muskegon Heights, Mich.

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Chattanooga Machinery Co., N. Chattanooga, Tenn.

Davis Machine Co., Inc., C. F., 133 Andrews St., Rochester, N. Y.

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Simonds Mfg. Co., Fitchburg, Mass.

## **—Shear**

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Hoskins Mfg. Co., 467 Lawton Ave., Detroit, Mich.

Scientific Materials Co., Pittsburgh, Pa.

Standard Scientific Co., 70 Fifth Ave., New York

# **LABORATORY WARE**

Corning Glass Works, Corning, N. Y.

Day Co., J. H., 1144 Harrison Ave., Cincinnati, O.

Eimer & Amend, 205 Third Ave., N. Y.

Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. R. R. Ave., Newark, N. J.

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Cook Belting Co., H. N., 401 Howard St., San Francisco, Cal.

Coupe Co., Wm., Ltd. (Excelsior), South Attleboro, Mass.

Couse & Bolten, 42 Lafayette St., Newark, N. J.

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Flather Mfg. Co., The J., Nashua, N. H.

Hardinge Bros., Inc., 1770 Beauteau Ave., Chicago, Ill.

Lehmann Machine Co., 606-612 S. Broadway, St. Louis, Mo.

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**Cincinnati Lathe & Tool Co.**, 3207-3211 North St., Oakley, Cincinnati, O.

**Davis Machine Tool Co., Inc.**, 305 St. Paul St., Rochester, N. Y.

**Dreses Machine Tool Co.**, 227 N. McMicken Ave., Cincinnati, O.

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Bell Locomotive Wks., Inc., 11 Pine St., N. Y. C.

Cummings Machine Co., Minster, O.

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McKean Motor Car Co., 1222 Webster St., Omaha, Neb.

Whitcomb Co., George D., Rochelle, Ill.

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Climax Mfg. Co., Corry, Pa.

Heisler Locomotive Works, Erie, Pa.

Lima Locomotive Works, Inc., Lima, O.

**—Logging**

Climax Mfg. Co., Corry, Pa.

Heisler Locomotive Works, Erie, Pa.

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American Locomotive Co., 30 Church St., New York

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Porter Co., H. K., 1208 Union Bank Bldg., Pittsburgh, Pa.

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Washington Iron Works, 1100 Seattle Boulevard, Seattle, Wash.

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 Keystone Lubricating Co., 21st, Clearfield, & Lippincott Sts., Philadelphia, Pa.  
 New York & New Jersey Lubricant Co., 165 Broadway, New York  
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 Petroleum Refining Co., 1502 Carter Bldg., Houston, Tex.  
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 Nathan Mfg. Co., Lawrence & Amity Sts., Flushing, Long Island, N. Y.  
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 Powell Co., Wm., 2521-31 Spring Grove Ave., Cincinnati, O.  
 Swain Lubricator Co., 443 W. 37th St., Chicago, Ill.  
 Williams Valve Co., D. T., Cincinnati, O.  
 Wood Robert, 15 Hawthorne St., Brooklyn, N. Y.

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American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, O.

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 Empire Axle Co., Dunkirk, N. Y.  
 Frictionless Metal Co., 1103 Chestnut St., Chattanooga, Tenn.  
 Frontier Iron Works, 36 Letchworth St., Buffalo, N. Y.  
 Gibbs, Gas Engine Co. of Florida, 26 S. Main St., Jacksonville, Fla.

Gillespie Mfg. Corp'n, 12th & Monmouth Sts., Jersey City, N. J.  
 Gray Machine Tool Co., Inc., 2651 Main St., Buffalo, N. Y.  
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 Milholland Co., J. & J. B., 718 Fifth Ave., Pittsburgh, Pa.  
 Modern Mfg. Co., 75 Third St., Bridgeport, Conn.  
 Morgans & Wilcox Mfg. Co., Middletown, N. Y.  
 Munson, E. G., Carlton Ave., Utica, N. Y.  
 National Gauge Co., 300 Pacific St., Brooklyn, N. Y.  
 Nazareth Foundry & Machine Co., 41-45 Easton Road, Nazareth, Pa.  
 Nelsonville Foundry & Machine Co., Nelsonville, O.  
 Nestor Mfg. Co., 40 W. 13th St., New York  
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 Rochester Welding Works, 349 Orchard St., Rochester, N. Y.  
 Russell Wheel & Foundry Co., Detroit, Mich.  
 Schaeffer Machine Works, 35th & Grays Ferry Road, Philadelphia, Pa.  
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Thomas Spacing Machine Co., 1226 Fulton Bldg.,  
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Tin Pipe  
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Cross Engineering Co., Carbondale, Pa.  
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Ingersoll Milling Machine Co., Rockford, Ill.

—**Thread**

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Arcade Mfg. Co., Freeport, Ill.

B & B Mfg. Co., Inc., P. O. Box 974, Indianapolis,  
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Berkshire Mfg. Co., Cleveland, O.

Champion Foundry & Mach. Co., 2419 W. 14th  
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Thomas-Morse Aircraft Corp'n, Ithaca, N. Y.

Wright-Martin Aircraft Co., New Brunswick, N. J.

## —Air and Steam

Union Machine Co., 183 University Ave., St. Paul, Minn.

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Ferro Machine & Foundry Co., Cleveland, O.

Fisher Electrical Works, Detroit, Mich.

Hercules Motor Mfg. Co., Canton, O.

Herschell-Spillman Co., North Tonawanda, N. Y.

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Lycoming Foundry & Machine Co., Williamsport, Pa.

Matthews Engineering Co., King & Monroe Sts., Sandusky, O.

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Colonial Fan & Motor Co., Warren, O.

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Cushman Electric Co., 43 S. Main St., Concord, N. H.

Diehl Mfg. Co., Elizabethport, N. J.

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

Eck Dynamo & Motor Co., Belleville, N. J.

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Kimble Electric Co., 634 N. Western Ave., Chicago, Ill.

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Mechanical Appliance Co., Milwaukee, Wis.

Peerless Electric Co., Warren, O.

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Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, O.

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Monarch Mfg. Co., Toledo, O.

New York Lubricating Oil Co., 116 Broad St., New York City

New York &amp; New Jersey Lubricant Co., 165 Broadway, New York

O'Brien-Northrop Oil &amp; Chem. Co., St. Louis, Mo.

Penn Oil &amp; Supply Co., Oil City, Pa.

Petroleum Refining Co., 1502 Carter Bldg., Houston, Tex.

Standard Oil Co., Chicago, Ill.

Standard Oil Co. of New York, 26 Broadway, New York

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Lynch-Clarisey Co., 3211-3213 S. Wood St., Chicago, Ill.

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Eagle Oil &amp; Supply Co. (Eagleine), 44-45-46 India St., Boston, Mass.

Fiske Bros. Refining Co., 24 State St., N. Y. C.

Franklin Oil &amp; Gas Co., Bedford, O.

Gulf Refining Co., Pittsburgh, Pa.

Harris Oil Co., A. W., 326 S. Water St., Providence, R. I.

Hsley-Doubleday &amp; Co., 229-231 Front St., New York, N. Y.

Moore Oil Co., York St. &amp; McLean Ave., Cincinnati, O.

Oil City Oil &amp; Grease Co., Oil City, Pa.

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Universal Oil Co., 38 Fulton St., New York City

White &amp; Bagley Co. (Oilzum), 100 Foster St., Worcester, Mass.

Wolverine Lubricants Co. of N. Y., 80 Broad St., New York

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Bell &amp; Gossett Co., 609 W. 30th St., Chicago, Ill.

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**McLanahan-Stone Machine Co.**, Hollidaysburg,  
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**ORE MILLING MACHINERY**

**Colorado Iron Works Co.**, Box 989, Denver,  
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**Henderson-Willis Welding & Cutting Co.**,  
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**Waterhouse Welding Co.**, 2 Pelham St., Boston,  
 Mass.

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**Modern Engineering Co.**, 23rd & Walnut Sts.,  
 St. Louis, Mo.

**Waterhouse Welding Co.**, 2 Pelham St., Boston,  
 Mass.

**OXY-ACETYLENE WELDING**

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**OXYGEN GAS**

**Air Reduction Co., Inc.**, 120 Broadway, New  
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**Burdett Mfg. Co.**, 309 St. Johns Court, Chicago,  
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**Metals Welding Co.**, 4400 Perkins Ave., Cleve-  
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**Ideal Metallic Packing Co.**, South Stillwater,  
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\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp.* 138, 139, 140, 141

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Dominion Asbestos & Rubber Corp'n, 154 Nassau St., New York

Eureka Packing Co., 78-80 Murray St., New York

Federal Asbestos Co., Paterson, N. J.

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\*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p.* 200

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Keasbey Co., Robert A., 445 West St., New York

Knowlton Rubber Co., G. W., 60 Pearl St., Boston, Mass.

New Jersey Asbestos Co., Camden, N. J.

Plastic Metallic Packing Co. (Holdfast), 642 Engrs. Bldg., Cleveland, O.

Steam Equipment Mfg. Co., 8077 Jenkins Arcade Bldg., Pittsburgh, Pa.

U. S. Indestructible Gasket Co. (Klingtite), Hudson Terminal Bldg., New York

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Fibre Finishing Co. (Vellumoid), 27 State St., Boston, Mass.

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Adkins, Young & Allen Co., 561 W. Washington Blvd., Chicago, Ill.

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Casco Bar-Metallic Packing Co., 3559 Lincoln Ave., Chicago, Ill.

Crandall Packing Co., Palmyra, N. Y.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.

Dominion Asbestos & Rubber Corp'n, 154 St., New York

Eastern Machinery & Equipment Co., Inc., 1036 Commercial Trust Bldg., Philadelphia, Pa.

Excelsior Valve Co., 106-108 Fulton St., New York

Carlock Packing Co., Palmyra, N. Y.

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Walker & Co., Ltd., James, 27 Thames St., New York

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American Metallic Packing Co., 3621-23-25 Mexico Ave., North Side, Pittsburgh, Pa.

Casco Bar-Metallic Packing Co., 3559 Lincoln Ave., Chicago, Ill.

Clark Flexible Metallic Packing Co., 71 Kennebec St., Portland, Me.

Collins Metallic Packing Co. (Collins), 56-58 N. Second St., Philadelphia, Pa.

Comee Metallic Packing Co., Stevens Point, Wis.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.

Cunningham Metallic Packing Co., Kingsbridge, New York, N. Y.

Endura Mfg. Co., 63rd & Eastwick Ave., Philadelphia, Pa.

Eureka Packing Co., 78-80 Murray St., New York

Federal Metallic Packing Co. (Federalite), 48 Hanover St., Boston, Mass.

France Packing Co., Tacony, Philadelphia, Pa.

Gasket Supply Co., 1718 Ludlow St., Philadelphia, Pa.

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High-Speed Metallic Packing Co., 305 N. Michigan Ave., Chicago, Ill.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

Ideal Metallic Packing Co., South Stillwater, Minn.  
 Jerome-Edwards Metallic Packing Co., 320 N. May St., Chicago, Ill.  
 \*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York. *p. 200*  
 Katzenstein & Co., L., 358 West St., New York  
 Larkins Metallic Packing Co., 404 Duquesne Way, Pittsburgh, Pa.  
 Lubricating Metal Co. (Noheet), 2 Rector St., New York  
 Martell Packings Co., Elyria, O.  
 Merrill & Co., Wm. B. (Tripp Packing), 3368 Washington St., Jamaica Plain, Mass.  
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 Swain Lubricator Co., 443 W. 37th St., Chicago, Ill.  
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 —Oil  
 Fibre Finishing Co. (Vellumoid), 27 State St., Boston, Mass.  
 —Rawhide  
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 —Rod (Piston and Valve)  
 American Huhn Metallic Packing Co., Woolworth Bldg., New York  
 American Metallic Packing Co., North Side, Pittsburgh, Pa.  
 Brandt, Randolph, 70 Cortlandt St., New York  
 Cancos Mfg. Co., Bridge & Garden Sts., Bridesburg, Philadelphia, Pa.  
 Casco Bar-Metallic Packing Co., 3559 Lincoln Ave., Chicago, Ill.  
 Chesterton Co., A. W., 64 India St., Boston, Mass.  
 Clark Flexible Metallic Packing Co., 71 Kennebec St., Portland, Me.  
 Comce Metallic Packing Co., Stevens Point, Wis.  
 Crandall Packing Co., Palmyra, N. Y.  
 Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.  
 Crown Mfg. Co., Cleveland, O.  
 Dominion Asbestos & Rubber Corp'n, 154 Nassau St., New York  
 "Double Service" Packing Co., 246 Chestnut St., Philadelphia, Pa.  
 Durabla Mfg. Co., 114 Liberty St., New York  
 Eagle Oil & Supply Co. (Eagleine), 44-45-46 India St., Boston, Mass.  
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 Federal Metallic Packing Co., 48 Hanover St., Boston, Mass.  
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 Consolidated Rubber Co., Trenton, N. J.  
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 Davis, Frank H., 175 Richdale Ave., Cambridge, Mass.

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Baker Valve Co., Box 1772, Minneapolis, Minn.  
Dyer Co., G. H., 155 Brookline St., Cambridge, Mass.  
Ever-Tight Piston Ring Co., 1600 Kingsland Ave., St. Louis, Mo.  
Foster, Merriam & Co., Meriden, Conn.  
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Keys Piston Ring Co., 3047-49-51 Olive St., St. Louis, Mo.  
Micro Piston Ring Co. (Micro), 110-116 Nassau St., New York  
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Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.

Otis Steel Co., 3131 Lakeside Ave., Cleveland, O.

Penn Seaboard Steel Corp'n, Franklin Bank Bldg., Philadelphia, Pa.

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Lea-Courtenay Co., 5 Maine St., Newark, N. J.  
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Taber Pump Co., 291-297 Elm St., Buffalo,  
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Elmes Engineering Works, Chas. F., 215 N. Morgan St., Chicago, Ill.

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Gray Aldrich Co., Inc., 33 Commercial Wharf, Boston, Mass.

Hydraulic Press Mfg. Co., Mount Gilead, O.

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Wilson-Snyder Mfg. Co., 2-18 Ross St., Pittsburgh, Pa.

\*WORTHINGTON PUMP & MACHINERY CORP'N, 115 Broadway, New York. . . *pp. 35, 131, 575, 597*

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Luitweiler Pumping Engine Co., 123 Ames St., Rochester, N. Y.

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Ottumwa-Moline Engine & Pump Co., Ottumwa, Ia.

Rife Hydraulic Engine Mfg. Co., 90 West St., New York

**—Measuring (Gasoline or Oil)**

American Oil Pump & Tank Co., Findlay & Dalton Sts., Cincinnati, O.

Atlas Brass Fdy. Co., Columbus, O.

Dayton Pump & Mfg. Co., 5th & Northwood Sts., Dayton, Ohio

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Lobee Pump & Machinery Co., Dearborn & Bridge Sts., Buffalo, N. Y.

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**Price Electric Co.**, 1236-9 Euclid Ave., Cleveland, O.  
**Pyroelectric Instrument Co. (Northrup)**, 636-640 East State St., Trenton, N. J.  
**Queen-Gray Co.**, 616-620 Chestnut St., Philadelphia, Pa.  
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**Leeds & Northrup Co.**, 4901 Stenton Ave., Philadelphia, Pa.  
**Morse Thermo-Gage Co., Inc.**, 111 Eddy St., Ithaca, N. Y.  
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**Thwing Instrument Co.**, 3339 Lancaster Ave., Philadelphia, Pa.

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 Minnesota Radiator Co., 59th Ave. W., Duluth, Minn.  
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**RAMMERS, FOUNDRY**

Cleveland Pneumatic Tool Co., 6410 Hawthorne Ave., Cleveland, O.  
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 Davidson Tool Mfg. Corp'n, 120-124 Maiden Lane, New York  
 Detroit Reamer & Tool Co., 302 Congress St., East, Detroit, Mich.  
 Detroit Twist Drill Co., 634 Fort St., W., Detroit, Mich.  
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Kelly Reamer Co., 1555 Columbus Road, Cleveland, O.

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Schellenbach-Hunt Tool Co., 120 Opera Place, Cincinnati, O.

Scully-Jones Co. (Wetmore), 80 E. Jackson Blvd., Chicago, Ill.

Taft-Peirce Mfg. Co., Woonsocket, R. I.

**REAMING & COUNTERSINKING MACHINES**

Lakeside Bridge & Steel Co. (Labride), 404 Villard Ave., North Milwaukee, Wis.

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Pittsburgh Pipe Coil & Bending Co., P. O. Box  
 975, Pittsburgh, Pa.

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 Brunswick Refrigerating Co., New Brunswick,  
 N. J.

Buffalo Refrigerating Machine Co. (Carbonia),  
 126 Liberty St., New York

Carbondale Machine Co., Carbondale, Pa.  
 Castle Refrigerating Machine Co., Indianapolis,  
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Clothel Co., 61 Broadway, New York  
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Harris Ice Machine Works, 174 E. Water St.,  
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Howe Ice Machine Co., 2815-21 Montrose Ave.,  
 Chicago, Ill.

Isbell-Porter Co., 46 Bridge St., Newark, N. J.  
 Ice & Cold Machine Co., 3003 N. Broadway,  
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Jarvis Engineering Co., 261 Franklin St., Boston,  
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**\*JOHNS-MANVILLE CO.**, H. W., 296 Madison  
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Mayer Ice Machine & Engineering Co., Morris  
 St. & Hudson River, Jersey City, N. J.

Pennsylvania Engineering Co., 119-21 N.  
 Howard St., Philadelphia, Pa.

Phoenix Ice Machine Co., 2711 Church Ave.,  
 Cleveland, O.

Portsmouth Engine Co., Portsmouth, O.  
 Remington Machine Co., Wilmington, Del.

Roekler, H. B., 41 Maiden Lane, New York  
 Standard Construction Engrg. & Supply Co.,  
 1752 N. 29th St., Philadelphia, Pa.

Triumph Ice Machine Co. (Triumph), Cin-  
 cinnati, O.

United Iron Works, Oakland, Cal.  
 United Iron Works Co., Kansas City, Mo.

Utility Compressor Co., 355 Harper Ave. E.,  
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**—Blower**  
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 Ziermore Valve Co., Media, Pa.

**—Compressed Gas**  
 Bastian-Blessing Co., West Austin Ave. at La  
 Salle St., Chicago, Ill.

**—Damper**  
 Berry Engineering Co. (Berry), Chester, Pa.  
 Bushnell & Co., John S., 146 Liberty St., New  
 York

Carrick Engineering Co., 538 So. Clark St.,  
 Chicago, Ill.

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Eastwood Wire Mfg. Co., Belleville, N. J.



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 Hess & Barker, 618 Chestnut St., Philadelphia, Pa.  
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 Kitts Steam Specialty Co., 60 E. 1st St., Oswego, N. Y.  
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 Standard Regulator Co., 282 South St., Newark, N. J.  
 Thompson & Co., Richard, 126 Liberty St., New York  
 Walker & Sons, Thomas, 4617-4621 Tacony St., Frankford, Philadelphia, Pa.  
 Watts Regulator Co. (Lawrence), 250-252 Lowell St., Lawrence, Mass.

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\*GENERAL ELECTRIC CO., Schenectady, N. Y. *pp. 16-25, inc*  
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 Plouff Co., 1500 River St., Boston, Mass.  
 Ray Mfg. Co., 3247 Park Ave., Indianapolis, Ind.  
 "S-C" Regulator Mfg. Co., Crocker St. & Columbus Ave., Fostoria, O.  
 Steam Equipment Mfg. Co., 8077 Jenkins Arcade Bldg., Pittsburgh, Pa.  
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 Connelly Iron Sponge & Governor Co., 227 Fulton St., New York  
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National Regulator Co., 145 E. 34th St., New York

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Bishop & Babcock Co., E. 49th & Hamilton Ave., Cleveland, Ohio

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Hartford Engine Works, 223 State St., Hartford, Conn.

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Mereen-Johnson Machine Co., Minneapolis, Minn.

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**RETORTS, GAS**

Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

**REVERSING GEAR (Power—Locomotive)**

Economy Devices Corp'n, 30 Church St., New York

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Edgewater Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.

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Factory Engineering Co., 760 Hippodrome, Prospect Ave., Cleveland, O.

Hoevel Mfg. Co., 170 Ogden Ave., Jersey City, N. J.

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**—Circular (Metal)**

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Disston & Sons, Inc., Henry, Philadelphia, Pa.

Dyett Co., Frank J., 73 John St., Ilion, N. Y.

Espen-Lucas Machine Works, Front St. & Girard Ave., Philadelphia, Pa.

Hunter Saw & Machine Co., 57th & Butler Sts., Pittsburgh, Pa.

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Tabor Mfg. Co., 18th & Hamilton Sts., Philadelphia, Pa.

**—Grooving**

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Armstrong-Blum Mfg. Co., 333-357 N. Francisco Ave., Chicago, Ill.

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Myers Machine Tool Co., Second & Chestnut Sts., Columbia, Pa.

Napier Saw Works, Inc., Springfield, Mass.

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Thompson & Son Co., Henry G., New Haven, Conn.

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Reno Kaetker Electric Co., Gerke Bldg., Cincinnati, O.

—**Testing**

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Boston Scale & Machine Co., 100 Rugges, Boston, Mass.

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Computing Scale Co., Dayton, O.

CONVEYING WEIGHER CO., 90 West St., New York... *p.* 338

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—**Conveyor**

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Electric Weighing Co., 182 Thirteenth Ave., New York

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—**Coal**

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Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p.* 599

Jones of Binghamton, Inc., Binghamton, N. Y.

Standard Scale & Supply Co., 1631 Liberty Ave., Pittsburgh, Pa.

Toledo Scale Co., Toledo, O.

—**Dynamometer**

Toledo Scale Co., Toledo, O.

—**Fluid Pressure**

\*CROSBY STEAM GAGE & VALVE CO., 40 Central St., Boston, Mass... *p.* 244

—**Hanging**

AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p.* 227

—**Hopper**

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Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.

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AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p.* 227

Fairbanks & Co., E. & T., St. Johnsbury, Vt.

Howe Scale Co. of N. Y., 341 Broadway

\*HUNT CO., INC., C. W., West New Brighton, Staten Island, N. Y... *p.* 342, 343

—**Mine Tipple**

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Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.

Streeter-Amet Weighing & Recording Co., 4101-05 Ravenswood Ave., Chicago, Ill.

—**Monorail**

AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p.* 227

Toledo Scale Co., Toledo, O.

—**Picker Lap**

AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p.* 227

—**Platform**

AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p.* 227

Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.

Chatillon & Sons, John, 85-93 Cliff St., New York

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p.* 599

Jones of Binghamton, Inc., Binghamton, N. Y.

Toledo Scale Co., Toledo, O.

—**Railroad Track**

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Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p.* 599

Standard Scale & Supply Co., 1631 Liberty Ave., Pittsburgh, Pa.

Streeter-Amet Weighing & Recording Co., 4101-05 Ravenswood Ave., Chicago, Ill.

—**Wagon**

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FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill. . . *p. 599*

Jones of Binghamton, Inc., Binghamton, N. Y.

**SCLEROSCOPES** (Hardness Tester)

Shore Instrument & Mfg. Co., 555 W. 22nd St., New York

**SCRAP METAL BUNDLERS**

(See Bundlers, Scrap Metal)

**SCRAPING MACHINES** (Wood)

Whitney & Son, Inc., Baxter D., Winchendon, Mass.

**SCREENS****—Flume**

\*HUNT MACHINE CO., RODNEY, Orange, Mass. . . *p. 603*

WRIGHT WIRE CO., Worcester, Mass. . . *p. 387*

**—Monel Metal Wire**

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

**—Perforated Metal**

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill. . . *p. 337*

Erdle Perforating Co., 171 York St., Rochester, N. Y.

Harrington & King Perforating Co., 629 N. Union Ave., Chicago, Ill.

\*HENDRICK MFG. CO., Carbondale, Pa. . . *p. 669*

\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio. . . *pp. 344, 345*

Manhattan Perforated Metal Co., 237 Centre St., New York

Mundt & Sons, Charles, 53-65 Fairmount Ave., Jersey City, N. J.

**—Revolving**

BARTLETT & SNOW CO., C. O., Cleveland, O. . . *p. 336*

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill. . . *p. 337*

\*CHAIN BELT CO., Milwaukee, Wis. . . *pp. 132, 133*

CHALMERS & WILLIAMS, 1450 Arnold St., Chicago Heights, Ill. . . *p. 618*

\*HENDRICK MFG. CO., Carbondale, Pa. . . *p. 669*

\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio. . . *pp. 344, 345*

\*LINK-BELT CO., Philadelphia, Pa. . . *p. 341*

McLanahan-Stone Machine Co., Hollidaysburg, Pa.

ROBINS CONVEYING BELT CO., Park Row Bldg., New York. . . *p. 353*

\*SMITH & CO., F. L., 50 Church St., New York. . . *p. 621*

Walker & Ellicott, Wilmington, Del.

WELLER MFG. CO., 1820-1856 N. Kostner Ave., Chicago, Ill. . . *pp. 354, 355, 356*

WRIGHT WIRE CO., Worcester, Mass. . . *p. 387*

**—Shaking**

Associated Engrg. Co., Somerset, Ky.

BARTLETT & SNOW CO., C. O., Cleveland, O. . . *p. 336*

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill. . . *p. 337*

\*CHAIN BELT CO., Milwaukee, Wis. . . *pp. 132, 133*

CHALMERS & WILLIAMS, 1450 Arnold St., Chicago Heights, Ill. . . *p. 618*

Excavating & Screening Machinery Co., 743 Security Bldg., Minneapolis, Minn.

\*HENDRICK MFG. CO., Carbondale, Pa. . . *p. 669*

HOLMES & BROS., ROBT., Danville, Ill. . . *p. 380*

\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio. . . *pp. 344, 345*

\*LINK-BELT CO., Philadelphia, Pa. . . *p. 341*

ROBINS CONVEYING BELT CO., Park Row Bldg., New York. . . *p. 353*

Universal Road Mch. Co., Kingston, N. Y.

WILLIAMS PATENT CRUSHER & PULVERIZER CO., Old Colony Bldg., Chicago, Ill. . . *pp. 624, 625*

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**—Vibrating**

Sturtevant Mill Co., Harrison Square, Boston, Mass.

**—Water Intake (Traveling)**

\*CHAIN BELT CO., Milwaukee, Wis. . . *pp. 132, 133*

\*LINK-BELT CO., Philadelphia, Pa. . . *p. 341*

**—Well**

Cook, A. D., Lawrenceburg, Ind.

MARK MFG. CO., P. O. Box G, Chicago, Ill. . . *p. 197*

**—Wire**

BARTLETT & SNOW CO., C. O., Cleveland, O. . . *p. 336*

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill. . . *p. 337*

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

WRIGHT WIRE CO., Worcester, Mass. . . *p. 387*

**SCREW CUTTING DIES**

(See Dies, Thread Cutting)

**SCREW DRIVING MACHINES**

Reynolds Machine Co., N. West St., Massillon, O.

**—Electric (Portable)**

Neil & Smith Electric Tool Co., 813-815 Broadway, Cincinnati, O.

**SCREW JACKS**

(See Jacks, Screw)

**SCREW MACHINE PRODUCTS**

Albaugh-Dover Co., 2100 Marshall Blvd., Chicago, Ill.

AMERICAN STEAM GAUGE & VALVE MFG. CO., Boston, Mass. . . *pp. 164, 165*

Atlas Brass Fdy. Co., Columbus, O.

BABSON-DOW MFG. CO., 60 Fulda St., Roxbury, Boston, Mass. . . *p. 532*

Barnes Co., Wallace, Main St., Bristol, Conn.

Bell Co., 1555 Fillmore Ave., Buffalo, N. Y.

Belvidere Screw & Machine Co., Belvidere, Ill.

BLAKE & JOHNSON CO., Waterbury, Conn. . . *p. 644*

BROWN BAG FILLING MACHINE CO., Fitchburg, Mass. . . *p. 649*

Chicago Automatic Machine Co., 400-408 N. Oakley Blvd., Chicago, Ill.

Chicago Screw Co., 1026 S. Homan Ave., Chicago, Ill.

CINCINNATI SCREW CO., Twightwee, O. (Cincinnati Suburb) . . . *p. 533*

CORBIN SCREW CORP'N, New Britain, Conn. . . *p. 534*

Dallett Co., Thomas H., Broad & Federal Sts., Philadelphia, Pa.

Defiance Screw Machine Products Co., 731 Perry St., Defiance, O.

Detroit Screw Works, Detroit, Mich.

Eastern Machine Screw Corp'n, New Haven, Conn.

Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.

Fostoria Screw Co., Fostoria, O.

Hanson Bros., Plainville, Conn.

Hartford Machine Screw Co., Hartford, Conn.

Hill Pump Valve Co., Archer Ave., Canal & 23rd Sts., Chicago, Ill.

Humason Mfg. Co., Forestville, Conn.

Michigan Screw Co., Lansing, Mich.

Moore, Geo. W., 44 Farnsworth St., Boston, Mass.

NATIONAL ACME CO., Cleveland, O. . . *pp. 450, 451*

New Haven Screw Co., 191-193 Foster St., New Haven, Conn.

Niagara Brass Mfg. Co., Inc., 163 Adams St., Buffalo, N. Y.



Peninsular Milled Screw Co., 1090 Lafayette E., Detroit, Mich.  
 Perry-Fay Co., Elyria, O.  
 Phillips Mfg. Co., R. B., 3 Grand St., Court, Worcester, Mass.  
 \*PRECISION INSTRUMENT CO., Detroit, Mich... pp. 240, 241  
 Progressive Mfg. Co., Torrington, Conn.  
 Ramsdell Specialty Co., W. Boylston St., Worcester, Mass.  
 \*REED & PRINCE MFG. CO., Worcester, Mass... p. 539  
 St. Louis Screw Co., St. Louis, Mo.  
 Sabin Machine Co., Cleveland, O.  
 Sherman Klove Co., 4519 W. Harrison St., Chicago, Ill.  
 Shimer & Sons, Samuel J., Milton, Pa.  
 Smith Mfg. Co., F. H., 3037-3047 Carroll Ave., Chicago, Ill.  
 Standard Screw Products Co., Bellevue & Warren Ave., Detroit, Mich.  
 U. S. Automatic Co., Amherst, O.  
 Weiss, Louis T., 286 Taaffe Place, Brooklyn, N. Y.  
 Western Automatic Machine Screw Co., Elyria, O.  
 Wicaco Screw and Machine Works, Inc., N. E. cor. 7th & Wood St., Philadelphia, Pa.  
 Winchester Repeating Arms Co., New Haven, Conn.  
 Worcester Machine Screw Co., Worcester, Mass.

**SCREW MACHINES****—Automatic**

BROWN & SHARPE MFG. CO., Providence, R. I... p. 472  
 Chicago Automatic Machine Co., 406-408 N. Oakley Blvd., Chicago, Ill.  
 CLEVELAND AUTOMATIC MACHINE CO., Cleveland, O... p. 448  
 NATIONAL ACME CO., Cleveland, O... pp. 450, 451  
 P. W. V. Automatic Machine Corp'n, Fitchburg, Mass.

**—Automatic, Multiple Spindle**

Cincinnati Automatic Machine Co., Cincinnati, O.  
 Davenport Machine Tool Co., 34 N. 2nd St., New Bedford, Mass.  
 NATIONAL ACME CO., Cleveland, O... pp. 450, 451  
 NEW BRITAIN MACHINE CO., New Britain, Conn... p. 449  
 P. W. V. Automatic Machine Corp'n, Fitchburg, Mass.

**—Hand**

ACME MACHINE TOOL CO., Cincinnati, O... p. 430  
 Bardons & Oliver, 1133 Ninth St., Cleveland, O.  
 BROWN & SHARPE MFG. CO., Providence, R. I... p. 472  
 Dreses Machine Tool Co., 227 W. McMicken Ave., Cincinnati, O.  
 Foster Machine Co., Elkhart, Ind.  
 Garvin Machine Co., Spring & Varick Sts., New York  
 \*GREENFIELD TAP & DIE CORP'N, Greenfield, Mass... pp. 500, 501  
 HERCULES MACHINE & TOOL CO., INC., 50 Church St., New York, N. Y... p. 470  
 LYND-FARQUHAR CO., 419-425 Atlantic Ave., Boston, Mass... p. 464  
 Millholland Machine Co., W. K., Indianapolis, Ind.  
 Pierce Machine Tool Co., 617 W. Jackson Blvd., Chicago, Ill.  
 POTTER TOOL & MACHINE WORKS, S. A., 79 E. 130th St., New York... pp. 478, 479  
 P. W. V. Automatic Machine Corp'n, Fitchburg, Mass.  
 Smurr & Kamen Co., 328 N. Albany Ave., Chicago, Ill.  
 \*SOUTHWORTH MACHINE CO., Portland, Me... p. 441

WACHS CO., E. H., 1525 Dayton St., Chicago, Ill... p. 14  
 \*WARNER & SWASEY CO., Cleveland, O... pp. 444, 445

**—Semi-Automatic**

Chicago Automatic Machine Co., 400 N. Oakley Blvd., Chicago, Ill.  
 Smurr & Kamen Co., 328 N. Albany Ave., Chicago, Ill.  
 WOOD TURRET MACHINE CO. (Tilted Turret), Brazil, Ind... pp. 446, 447

**SCREW PLATES**

American Tap & Die Co. (Acme), Greenfield, Mass.  
 Butterfield & Co., Derby Line, Vt.  
 Card Mfg. Co., S. W., Rumford Ave., Mansfield, Mass.  
 Conant & Donelson Co. (Reliable), Conway, Mass.  
 \*GREENFIELD TAP & DIE CORP'N, Greenfield, Mass... pp. 500, 501  
 Oster Mfg. Co., 2057 E. 61st Place, Cleveland, O.  
 Russell Mfg. Co., Greenfield, Mass.  
 Winter Bros. Co., Wrentham, Mass.

**SCREW SHELLS**

Risdon Tool & Machine Co., Naugatuck, Conn.

**SCREW STEEL**

Brightman Mfg. Co., So. Columbus, O.  
 WHEELOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... p. 410

**—Cold Drawn**

Columbia Steel & Shafting Co., Pittsburgh, Pa.  
 New England Drawn Steel Co., Mansfield, Mass.  
 Standard Screw Products Co., Bellevue & Warren Ave., Detroit, Mich.  
 \*UNION DRAWN STEEL CO., Beaver Falls, Pa... p. 408

**SCREW THREAD ROLLING MACHINES**

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BLISS CO., E. W., Brooklyn, N. Y... pp. 418, 419

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 Chicago Screw Co., 1026 S. Homan Ave., Chicago, Ill.  
 CINCINNATI SCREW CO., Twilight, O. (Cincinnati Suburb)... p. 533  
 Clark Bros. Bolt Co., Milldale, Conn.  
 The Cleveland Wrought Products Co., Cleveland, Ohio  
 CORBIN SCREW CORP'N, New Britain, Conn... p. 534  
 Detroit Screw Works, Detroit, Mich.  
 Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.  
 Fostoria Screw Co., Fostoria, O.  
 Metals Welding Co., 4400 Perkins Ave., Cleveland, O.  
 New Haven Screw Co., 191-193 Foster St., New Haven, Conn.  
 Niagara Screw Co., 20 Lock St., Buffalo, N. Y.  
 Phillips Mfg. Co., R. B., 3 Grand St., Court, Worcester, Mass.  
 \*REED & PRINCE MFG CO., Worcester, Mass... p. 539  
 Rhode Island Tool Co., 148 West River St., Providence, R. I.  
 St. Louis Screw Co., St. Louis, Mo.  
 Shimer & Sons, Samuel J., Milton, Pa.  
 Steel Products Co., Cleveland, O.  
 Standard Screw Products Co., Bellevue & Warren Ave., Detroit, Mich.  
 U. S. Automatic Co., Amherst, O.  
 Western Automatic Machine Screw Co., Elyria, O.  
 Worcester Machine Screw Co., Worcester, Mass.  
 —Hot Mill  
 AMERICAN FORGE & MACHINE CO., Canton, Ohio... p. 411

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Bell Co., 1555 Filmore Ave., Buffalo, N. Y.  
BLAKE & JOHNSON CO., Waterbury, Conn.  
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CINCINNATI SCREW CO., Twightwee, O.  
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CORBIN SCREW CORP'N, New Britain,  
Conn. p. 534

Detroit Screw Works, Detroit, Mich.

FALLS RIVET CO., Kent, O. p. 537

Hubbell, Inc., Harvey, Bridgeport, Conn.

Keystone Screw Co., 17th St. & Lehigh Ave.,  
Philadelphia, Pa.

National Screw & Tack Co., 7413 Stanton Ave.,  
Cleveland, O.

Niagara Screw Co., 20 Lock St., Buffalo, N. Y.  
Peninsular Milled Screw Co., 1090 Lafayette  
East, Detroit, Mich.

Perry-Fay Co., Elyria, O.

Phillips Mfg. Co., R. B., 3 Grand St., Court,  
Worcester, Mass.

Progressive Mfg. Co., Torrington, Conn.

\*REED & PRINCE MFG. CO., Worcester,  
Mass. p. 539

Scovill Mfg. Co., Waterbury, Conn.

Worcester Machine Screw Co., Worcester,  
Mass.

**—Safety Set**

Allen Mfg. Co., 135 Sheldon St., Hartford,  
Conn.

BRISTOL CO., Waterbury, Conn. p. 248  
The Cleveland Wrought Products Co., Cleve-  
land, Ohio

Flower & Co., Walter L., 312-314 S. 8th St.,  
St. Louis, Mo.

New Haven Screw Co., 191-193 Foster St.,  
New Haven, Conn.

Progressive Mfg. Co., Torrington, Conn.

Standard Pressed Steel Co., 20th & Clearfield  
Sts., Philadelphia, Pa.

**—Socket Head**

Allen Mfg. Co., 135 Sheldon St., Hartford, Conn.

**—Thumb**

WILLIAMS & CO., J. H., 70 Richards St.,  
Brooklyn, N. Y. p. 530

**—Wood**

AMERICAN SCREW CO., Providence, R. I.  
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Bridgeport Screw Co., Bridgeport, Conn.

CORBIN SCREW CORP'N, New Britain,  
Conn. p. 534

Reading Screw Co., Norristown, Pa.

\*REED & PRINCE MFG. CO., Worcester,  
Mass. p. 539

**SEALING MACHINES**

(See Carton Sealing Machines)

**SEPARATORS****—Ammonia**

\*DE LA VERGNE MACHINE CO., 1123 E.  
138th St., New York. p. 33

\*VOGT MACHINE CO., HENRY, Louis-  
ville, Ky. pp. 70, 71

**—Centrifugal**

Sharples Specialty Co., West Chester, Pa.

**—Gasoline**

Bousman Mfg. Co., 1153-57 Plainfield Ave.,  
N. E. Grand Rapids, Mich.

**—Magnetic**

Buchanan Co., C. G., Inc., 90 West St., New  
York

Dienelt & Eisenhardt, Inc., 1304 N. Howard St.,  
Philadelphia, Pa.

**—Metal Chip**

AMERICAN TOOL & MACHINE CO., Boston,  
Mass. p. 641

\*DE LAVAL STEAM TURBINE CO., 580  
Jackson Ave., Trenton, N. J. p. 15

National Separator & Machine Co., 89 State  
St., Boston, Mass.

OIL & WASTE SAVING MACHINE CO.,  
1509 Real Estate Trust Bldg., Philadelphia,  
Pa. p. 642

**—Oil**

Albany Steam Trap Co., 317 N. Pearl St.,  
Albany, N. Y.

Anderson Co., V. D., W. 96th St., Cleveland, O.  
Baragwanath & Son, Wm., 1633 Monadnock  
Block, Chicago, Ill.

\*CRANE CO., 836 S. Michigan Ave., Chicago,  
Ill. pp. 138, 139, 140, 141

\*DE LAVAL STEAM TURBINE CO., 580  
Jackson Ave., Trenton, N. J. p. 15

Direct Separator Co., Syracuse, N. Y.

Harrison Safety Boiler Works, 3130 North 17th  
St., Philadelphia, Pa.

\*ILLINOIS ENGINEERING CO., Racine at  
21st St., Chicago, Ill. pp. 170, 171, 172

Kelley & Son, Benj. F., 25 Church St., New  
York

KIELEY & MUELLER, INC., 34 W. 13th St.,  
New York. p. 173

\*NATIONAL PIPE BENDING CO., New  
Haven, Conn. pp. 124, 125

OIL & WASTE SAVING MACHINE CO.,  
1509 Real Estate Trust Bldg., Philadelphia,  
Pa. p. 642

Open Coil Heater & Purifier Co., Indianapolis,  
Ind.

\*PITTSBURGH VALVE, FOUNDRY &  
CONST. CO., Pittsburgh, Pa. pp. 156, 157

Power Plant Specialty Co. (Vater), 1306 Monad-  
nock Block, Chicago, Ill.

Standard Steam Specialty Co. (Utility),  
542 West Broadway, New York

UNITED MACHINE & MFG. CO., Canton,  
O. p. 177

Vance-Vetter Co. (Baum), Phipps Power  
Bldg., Pittsburgh, Pa.

Webster & Co., Warren, Point & Pearl Sts.,  
Camden, N. J.

**—Oil and Gas**

PETROLEUM IRON WORKS CO. (Wash-  
ington), Sharon, Pa. pp. 672, 673

**—Steam**

Colles Heater & Specialty Co., 14 E. Jackson  
Blvd., Chicago, Ill.

\*CRANE CO., 836 S. Michigan Ave., Chicago,  
Ill. pp. 138, 139, 140, 141

D'ESTE CO., JULIAN, 26 Canal St., Boston,  
Mass. pp. 166, 167

Direct Separator Co., Syracuse, N. Y.

\*ILLINOIS ENGINEERING CO., Racine  
Ave., at 21st St., Chicago, Ill. pp. 170,  
171, 172

Jacobs & Co., Charles (Lowden), 258 Franklin  
St., Boston, Mass.

KIELEY & MUELLER, INC., 34 W. 13th  
St., New York. p. 173

\*NATIONAL PIPE BENDING CO., New  
Haven, Conn. pp. 124, 125

Nicholson & Co., W. H., Wilkes-Barre, Pa.

Nightingale & Childs Co., 205 Congress St.,  
Boston, Mass.

Open Coil Heater & Purifier Co., Indianapolis,  
Ind.

PETROLEUM IRON WORKS CO., Sharon,  
Pa. pp. 672, 673

\*PITTSBURGH VALVE, FOUNDRY &  
CONST. CO., Pittsburgh, Pa. pp. 156, 157

Plant Engineering & Equipment Co., Inc.,  
192 Broadway, New York

Power Plant Specialty Co. (Vater), 1306 Monad-  
nock Block, Chicago, Ill.

Provost Engineering Corp'n, 220 Broadway,  
Brooklyn, N. Y.

Robertson & Sons, Jas. L. (Hine), 78-80 Murray  
St., New York

Ross Schofield Co., 17 Battery Place, New York

Sims Co., Erie, Pa.

Steam Appliance Co., West Allis, Wis.

Steam Equipment Mfg. Co., 8077 Jenkins  
Arcade Bldg., Pittsburgh, Pa.

UNITED MACHINE & MFG. CO., Canton,  
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Vance-Vetter Co. (Baum), Phipps Power Bldg., Pittsburgh, Pa.

### SET COLLARS

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### SETTING-UP APPLIANCES (For Machine Tools)

STANDARD SHOP EQUIPMENT CO., 1413 Somerset St., Philadelphia, Pa... *p. 527*

### SEWAGE EJECTORS

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### SHACKLES, CHAIN

Merrill Bros., Maspeth, N. Y.

Weimer Chain & Iron Co., Lebanon, Pa.

### SHAFTING

Bliss & Laughlin, Inc., Harvey, Ill.

\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio... *pp. 344, 345*

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### —Cold Drawn

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Blum & Co., Julius, 532-40 W. 22nd St., New York

Cumberland Steel Co., Cumberland, Md.

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Fitzsimmons Co., Youngstown, O.

\*HILL CLUTCH CO., Cleveland, O... *p. 287*

MEDART PATENT PULLEY CO., St. Louis, Mo... *p. 289*

New England Drawn Steel Co., Mansfield, Mass.

Pardee Works, C., Perth Amboy, N. J.

\*UNION DRAWN STEEL CO., Beaver Falls, Pa... *p. 408*

WELLER MFG. CO., 1820-1856 N. Kostner Ave., Chicago, Ill... *pp. 354, 355, 356*

### —Flexible

Chicago Flexible Shaft Co., 579 La Salle Ave., Chicago, Ill.

Coates Clipper Mfg. Co., 237 Chandler St., Worcester, Mass.

Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

Haskins Co., R. G., 547 Washington Blvd., Chicago, Ill.

Plank Flexible Shaft Machine Co., Grand Rapids, Mich.

Stow Flexible Shaft Co., 26th & Callowhill Sts., Philadelphia, Pa.

Stow Mfg. Co., 443 State St., Binghamton, N. Y.

Webb Mfg. Co., Foot of Centre St., Newark, N. J.

WHITE DENTAL MFG. CO., S. S., 5-7-9 Union Square, W., New York... *p. 315*

### —Forged

Crucible Steel Forge Co., 6607 Grant Ave., Cleveland, O.

Johnson & Co., Inc., J. R., P. O. Box 515, Richmond, Va.

### —Forged and Turned

\*HILL CLUTCH CO., Cleveland, O... *p. 287*

### —Turned and Ground

AMERICAN TOOL & MACHINE CO., Boston, Mass... *p. 641*

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill... *p. 337*

Cumberland Steel Co., Cumberland, Md.

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### —Turned and Polished

Aborn Steel Co., Inc., 22 Clarke St., N. Y. C.

AMERICAN TOOL & MACHINE CO., Boston, Mass... *p. 641*

Bliss & Laughlin, Inc., Harvey, Ill.

Brightman Mfg. Co., So. Columbus, O.

\*BROWN CO., A. & F., 79 Barclay St., New York... *p. 261*

\*CALDWELL & SON CO., H. W., 17th St. & Western Ave., Chicago, Ill... *p. 337*

Central Steel & Wire Co., 119 N. Peoria St., Chicago, Ill.

Columbia Steel & Shafting Co., Pittsburgh, Pa.

Compressed Steel Shafting Co., 393 Dorchester Ave., Boston, Mass.

DODGE SALES & ENGINEERING CO., Mishawaka, Ind... *pp. 119, 282, 283, 284, 285, 286*

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\*HILL CLUTCH CO., Cleveland, O... *p. 287*

\*LINK-BELT CO., Philadelphia, Pa... *p. 341*

MEDART PATENT PULLEY CO., St. Louis, Mo... *p. 289*

\*UNION DRAWN STEEL CO., Beaver Falls, Pa... *p. 408*

\*WOOD'S SONS CO., T. B., Chambersburg, Pa... *pp. 292, 293*

### SHAKING GRATES

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### SHAPER ATTACHMENTS

Stockbridge Machine Co., 68 Abbott St., Worcester, Mass.

### SHAPERS

American Tool Work Co., Pearl & Eggleston Ave., Cincinnati, O.

Cincinnati Shaper Co., Cincinnati, O.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Gould & Eberhardt, Chancellor Ave., Irvington, N. J.

Hendey Machine Co., Torrington, Conn.

Hollingsworth Machine Tool Co., 2nd & Greenup Sts., Covington, Ky.

Kelly Co., R. A. (Kelly), Xenia, O.

LYND-FARQUHAR CO., 419-425 Atlantic Ave., Boston, Mass... *p. 464*

Milwaukee Shaper & Transmission Appliance Co., 1148-50 Holton St., Milwaukee, Wis.

Morton Mfg. Co., Muskegon Heights, Mich.

Ohio Machine Tool Co., Kenton, O.

Potter & Johnson Machine Co., Pawtucket, R. I.

PRATT & WHITNEY CO., 111 Broadway, New York... *p. 461*

Rhodes Mfg. Co., 984 Park St., Hartford, Conn.

Smith & Mills Co., Cincinnati, O.

Springfield Machine Tool Co., Springfield, O.

Steptoe Co., John, Cincinnati, O.

Stockbridge Machine Co., 68 Abbott St., Worcester, Mass.

### —Draw Cut

Morton Mfg. Co., Muskegon Heights, Mich.

### —Heavy Duty

Morton Mfg. Co., Muskegon Heights, Mich.

### —Pillar

Cincinnati Shaper Co., Cincinnati, O.

Columbia Machine Tool Co., Fairgrove Ave., Hamilton, O.

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### —Travelling Head

Boynton & Plummer, Inc., Chester Depot, Vt.

Cincinnati Shaper Co., Cincinnati, O.

### SHAPES

#### —Iron

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#### —Steel

Franklin Steel Works, Franklin, Pa.

GLASGOW IRON CO., 15th & Market Sts., Philadelphia, Pa... *p. 76*

Hamilton & DeLoss, Bridgeport, Conn.

Jones & Laughlin Steel Co., 3rd Ave. & Ry., Pittsburgh, Pa.

Phoenix Iron Co., 22 So. 15th St., Philadelphia, Pa.

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McCord & Co., Chicago, Ill.

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Worcester Stamped Metal Co., 9 Hunt St., Worcester, Mass.

**—Structural**

McDermott Engineering Co., Whitehall & Jordan Sts., Allentown, Pa.

**SHARPENING DEVICES**

Chicago Wheel & Mfg. Co., 1101-1103 W. Monroe St., Chicago, Ill.

INGERSOLL-RAND CO., 11 Broadway, New York... *pp. 572, 573*

Luther Grinder Mfg. Co., 285 S. Water St., Milwaukee, Wis.

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**SHEARS**

**—Alligator**

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**—Angle**

Badger State Machine Co., Janesville, Wis.

Cedar Rapids Foundry & Machine Co., 901-998 2nd Ave. W., Cedar Rapids, Iowa

Doelger & Kirsten, 505-507 Cedar St., Milwaukee, Wis.

Kidder Mfg. Co., J. F., Burlington, Vt.

Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill.

Lewthwaite Machine Co., T. H., 415 E. 31st St., New York

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Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.

WICKES BROS., Saginaw, Mich... *p. 443*

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**—Bar**

Badger State Machine Co., Janesville, Wis.

Hendley & Whittemore Co., Beloit, Wis.

Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill.

Lewthwaite Machine Co., T. H., 415 E. 31st St., New York

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Youngstown Foundry & Machine Co., Youngstown, O.

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**—Gate**

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Heartley Machine, Variety Iron & Tool Works, Summit & Locust Sts., Toledo, O.

Hendley & Whittemore Co., Beloit, Wis.

Oliver Mfg. Co., W. W., 1483 Niagara St., Buffalo, N. Y.

TORRINGTON MFG. CO., Torrington, Conn... *p. 645*

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Badger State Machine Co., Janesville, Wis.

Beatty Machine & Mfg. Co., Hammond, Ind.

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Badger State Machine Co., Janesville, Wis.

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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

Canton Foundry & Machine Co. (Canton), Canton, O.

Cedar Rapids Foundry & Machine Co., 901-908 2nd Ave. W., Cedar Rapids, Iowa

Clark Foundry Co., Rumford, Me.

Cleveland Punch & Shear Works Co., Cleveland, O.

Covington Machine Co., Covington, Va.

Imperial Machine Co., 1811 Central Ave., Minneapolis, Minn.

Ironton Punch & Shear Co., 511 N. 2nd St., Ironton, O.

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Loy & Nawrath Co., 21-29 Runyon St., Newark, N. J.

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Stoll Co., D. H., 28 Lansing St., Buffalo, N. Y.

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Kling Bras. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill.

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 Hoston Co., Inc., John T., 157th St. & 8th Ave., New York  
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 Codd Co., E. J., 700 S. Caroline St., Baltimore, Md.  
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Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

Geuder, Paeschke & Frey Co., 1351 St. Paul Ave., Milwaukee, Wis.

Hamilton & DeLoss, Bridgeport, Conn.

\*HENDRICK MFG. CO., Carbondale, Pa...*p. 669*

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Howard & Morse, 45 Fulton St., New York

\*KEELER CO., E., Williamsport, Pa...*p. 55*

KROESCHELL BROS. CO., 460 West Erie St., Chicago, Ill...*p. 58*

McCall Machine Works, Rochester, N. Y.

C. J. Merrill, Inc., 85 Kennebec St., Portland, Me.

MILWAUKEE RELIANCE BOILER WORKS, Milwaukee, Wis...*p. 123*

National Blow Pipe & Mfg. Co., 738 Dryades St., New Orleans, La.

Northern Blower Co., Cleveland, Ohio

Richmond Engineering Co., 12 S. 8th St., Richmond, Va.

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Van Noorden Co., E., 102 Magazine St., Roxbury, Mass.

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Wilson Steam Boiler Co., 1919-27 S. 20th St., Omaha, Neb.

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Dreis Krump Mfg. Co., 2919 So. Halsted St., Chicago, Ill.

Engine & Machinery Co., Marion Ave. & Navarre Rd. S. W., Canton, Ohio

Leffer & Co., Charles, 49-73 Clymer St., Brooklyn, N. Y.

Loy & Nawrath Co., 21-29 Runyon St., Newark, N. J.

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V & O Press Co., Glendale, L. I., N. Y.  
 Yoder Co., 1024 B. of L. E. Bldg., Cleveland, O.

#### SHEET MILL MACHINERY

Aetna Foundry & Machine Co., Warren, O.

#### SHEETS

##### —Aluminum

Cleveland Metal Products Co., 7609 Platt Ave., Cleveland, O.

##### —Brass

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##### —Copper

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##### —Galvanized

American Sheet & Tin Plate Co., Pittsburgh, Pa.

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American Hard Rubber Co., 11 Mercer St., New York

Stokes Rubber Co., Jos., Trenton, N. J.

##### —Nickel

Haring, Ellsworth, 114 Liberty St., New York

##### —Steel

Allegheny Steel Co., Pittsburgh, Pa.

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Andrews Steel Co., Newport, Ky.  
Haring, Ellsworth, 114 Liberty St., New York  
Jessop & Sons, Inc., Wm., 91 John St., New York  
MARK MFG. CO., P. O. Box G, Chicago, Ill.  
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Wood Iron & Steel Co., Alan, Widener Bldg., Philadelphia, Pa.  
Youngstown Sheet & Tube Co., Youngstown, O.  
—Tin  
Bethlehem Steel Co., Bethlehem, Pa.

—Zinc

Hazel, Atlas Glass Co., Wheeling, W. Va.  
Illinois Zinc Co., Peru, Ill.

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Darby & Sons Co., Inc., Edward, 233-235 Arch St., Philadelphia, Pa.  
Dexter Metal Mfg. Co., Camden, N. J.  
Durand Steel Locker Co., 76 W. Monroe St., Chicago, Ill.  
EDWARDS MFG. CO., 306-336 Eggleston Ave., Cincinnati, O...pp. 680, 681  
Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.  
Lyon Metallic Mfg. Co., Aurora, Ill.  
National Scale Co., Chicopee Falls, Mass.  
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**SHIPYARD MACHINERY**

Norbom Engineering Co., 712 Denckla Bldg., Philadelphia, Pa.

**SHOE LACE TIPPING MACHINES**

Franklin Machine Co., 189 Charles St., Providence, R. I.

**SHOE MAKING MACHINERY**

Freeman Co., Louis G., Cincinnati, Ohio

**SHOP FURNITURE**

Manufacturing Equipment & Engineering Co., Framingham, Mass.

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Thew Automatic Shovel Co., Lorain, Ohio  
Toledo Foundry & Machine Co., Toledo, Ohio

**SHREDDING MACHINES**

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\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio...pp. 344, 345  
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**SILK MANUFACTURING MACHINERY**

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Drouve Co., G. (Anti-Pluvius), Bridgeport, Conn.

**EDWARDS MFG. CO.**, 306-336 Eggleston Ave., Cincinnati, O...*pp. 680, 681*  
**Keighley Metal Ceiling & Mfg. Co.**, S., 124 3rd Ave., Pittsburgh, Pa.  
**Lupton's Sons Co.**, David, Tulip St. & Allegheny Ave., Philadelphia, Pa.  
**Van Noorden Co.**, E., 102 Magazine St., Roxbury, Mass.

**SLABS, STEEL**

**American Tube & Stamping Co.**, Bridgeport, Conn.

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**Newton Machine Tool Works, Inc.**, 23rd & Vine Sts., Philadelphia, Pa.

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**Colorado Iron Works Co.**, Box 989, Denver, Colo.

**Traylor Engrg. & Mfg. Co.**, Allentown, Pa.

**SMOKE CONSUMERS**

**Monarch Soot Remover Co., Inc.**, 261 Franklin St., Boston, Mass.

**SMOKE RECORDERS**

**Hamler Eddy Smoke Recorder CO.**, 3906 S. Halsted St., Chicago, Ill.

**SMOKE STACKS AND FLUES**

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**SMOKELESS FURNACES**

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**National Lead Co.**, 111 Broadway, New York

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**Vulcan Soot Cleaner Co. (Vulcan)**, DuBois, Pa.

**SPACING TABLES (Structural Shop)**, Steel Utilities, Inc., 425 Kinney Bldg., Newark, N. J.

**Thomas Spacing Machine Co.**, 1226 Fulton Bldg., Pittsburgh, Pa.

**SPARK PLUGS**

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**SPECIAL MACHINERY**

**Advance Mfg. Co.**, Hamilton, O.

**Akron Gear & Engineering Co.**, Cor. South & High Sts., Akron, O.

**American & British Mfg. Co.**, Bridgeport, Conn.

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**Baird Machine Co.**, The, Bridgeport, Conn.

**Bethlehem Steel Co.**, Bethlehem, Pa.

**Bickett Machine & Mfg. Co.**, Cincinnati, O.

**Boeger-Meyer Machine & Tool Co.**, 59-65 McWhorter St., Newark, N. J.

**Bradley Machine Co.**, Bridgeport, Conn.

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**City Machine & Tool Works**, 3rd & Pine Sts., Dayton, O.

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**Cleveland Machine Tool Co.**, 3215 Superior Ave., Cleveland, O.

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**Cooper Co.**, C. & G., Mt. Vernon, O.  
**Cowdrey Machine Works**, C. H., 20 Main St., Fitchburg, Mass.  
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**Diamant Tool & Mfg. Co., Inc.**, 91-97 Runyon St., Newark, N. J.  
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**Gem City Machine Co.**, 434 E. First St., Dayton, O.  
**Gerdes Co., Inc.**, 30 Church St., New York  
**Greenlee Bros. & Co.**, Rockford, Ill.  
**Griswold Machine Co.**, Geo. M., New Haven, Conn.  
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**Hart & Co., Inc.**, Frederick, 837 Main St., Poughkeepsie, N. Y.  
**Hay's Sons, Sam'l W.**, 1410 Keenan Bldg., Pittsburgh, Pa.  
**Hinsman Machine & Tool Co.**, Elm St., Westfield, Mass.  
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**Langelier Mfg. Co.**, 51 Washington Ave., Arlington, Cranston, R. I.  
**Lebanon Gear & Machine Works**, Forge St., Lebanon, Pa.  
**Lincoln Iron Works**, 255 West St., Rutland, Vt.  
**Lincoln Machine Co.**, Main & Carver Sts., Pawtucket, R. I.  
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**Mehl Machine Tool & Die Co. (Mehl Made)**, Roselle, N. J.  
**Meryanthaler Co.**, Baltimore, Md.  
**Meriden Press & Drop Co.**, 153 State St., Meriden, Conn.  
**Munson, F. G.**, Carton Ave., Utica, N. Y.  
**Nestor Mfg. Co.**, 40 W. 13th St., New York  
**Nilson Machine Co.**, A. H., 1525 Railroad Ave., Bridgeport, Conn.  
**Nilson-Miller Co.**, 1300 Huason St., Hoboken, N. J.  
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**\*POOLE ENGINEERING & MACHINE CO.**, Woodberry, Baltimore, Md... *pp. 274, 275*  
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**Pratt Engineering & Machine Co.**, Atlanta, Ga.  
**Production Tool & Engrg. Co.**, 507 W. Jackson Blvd., Chicago, Ill.  
**Redington & Co.**, F. B., 112 S. Sangamon St., Chicago, Ill.  
**Richmond Metal Products Co., Inc.**, 5th & Arch Sts., Richmond, Va.  
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**Russel Wheel & Foundry Co.**, Detroit, Mich.  
**Sheffield Machine & Tool Co.**, Dayton, O.  
**Shepherd Engineering Co.**, Williamsport, Pa.  
**Sigourney Tool Co.**, 9 Sigourney St., Hartford, Conn.  
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**Steady-Schmidt Mfg Co.**, 230 E. Hay St., York, Pa.  
**Stecher Co.**, Charles, 1578 Crossing St., Chicago, Ill.  
**Steel Products Engineering Co.**, Springfield, O.  
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**Turley Gear & Machine Co.**, 1505 N. 10th St., St. Louis, Mo.  
**Turner-Fricke Mfg. Co.**, Pittsburgh, Pa.  
**Ulmer Co.**, J. C., 1791 E. 38th St., Cleveland, O.  
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**Walsh Press & Die Co.**, 4709 W. Kinzie St., Chicago, Ill.  
**Waltham Machine Works**, Waltham, Mass.  
**Wilson Machine Co.**, W. A., 217 N. Water St., Rochester, N. Y.  
**Wunsch & Washburn**, 487 Broadway, N. Y. (N. Y. Office)  
**Yoder Co.**, 1024 B. of L. E. Bldg., Cleveland, O.  
**York Electric & Machine Co.**, 30-34 N. Penn St., York, Pa.

**SPEED REDUCING GEARS**  
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**SPELTER, BRAZING**  
**Michigan Smelting & Refining Co.**, Detroit, Mich.

**SPIKE MACHINES**  
**Youngstown Foundry & Machine Co.**, Youngstown, O.

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Star Brass Works, 3114-20 Carroll Ave., Chicago, Ill.

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### SPRAYING MACHINERY

#### —Metal

Metals Coating Co. of America, 100 Sumner St., Boston, Mass.

#### —Paint

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 590*

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#### —Oil

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American Steel Foundries, 332 S. Michigan Ave., Chicago, Ill.

Pittsburgh Spring & Steel Co., 1417 Farmers' Bank Bldg., Pittsburgh, Pa.

Railway Steel Spring Co., 30 Church St., New York

UNION SPRING & MFG. CO., 1207 Fulton Bldg., Pittsburgh, Pa... *p. 546*

#### —Clock and Phonograph

Barnes Co., Wallace, Main St., Bristol, Conn.

#### —Coiled

Barnes Co., Wallace, Main St., Bristol, Conn.

Cook Spring Co., 420 E. 106th St., New York

New York Wire & Spring Co., 586 Washington St., New York

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#### —Elliptic

UNION SPRING & MFG. CO., 1207 Fulton Bldg., Pittsburgh, Pa... *p. 546*

#### —Flat

Barnes Co., Wallace, Main St., Bristol, Conn.

#### —Machinery

Barnes Co., Wallace, Main St., Bristol, Conn.

Cleveland Wire Spring Co., Cleveland, O.

Pittsburgh Spring & Steel Co., 1417 Farmers' Bank Bldg., Pittsburgh, Pa.

Raymond Mfg. Co., Ltd., Corry, Pa.

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#### —Steel

Cary Spring Works, 240 W. 29th St., New York

Duer Spring & Mfg. Co., P. O. Box 1045, Pittsburgh, Pa.

Miller Wire Spring Co. (Oil Tempered), Bridgeport, Conn.

New York Wire & Spring Co., 586 Washington St., New York

Pittsburgh Spring & Steel Co., 1417 Farmers' Bank Bldg., Pittsburgh, Pa.

#### —Vanadium

Barnes Co., Wallace, Main St., Bristol, Conn.

Cook Spring Co., 420 E. 106th St., New York

New York Wire & Spring Co., 586 Washington St., New York

Raymond Mfg. Co., Ltd., Corry, Pa.

#### —Vehicle (Flat Leaf)

Duer Spring & Mfg. Co., P. O. Box 1045, Pittsburgh, Pa.

Hess Spring & Axle Co., 124 W. 66th St., Carthage, Cincinnati, O.

Liggett Spring & Axle Co., Monongahela, Pa.

Sheldon Axle & Spring Co., Wilkes-Barre, Pa.

#### —Wire

Barnes Co., Wallace, Main St., Bristol, Conn.

Cook Spring Co., 420 E. 106th St., New York

Cuyahoga Spring Co., Waterloo Road, Cleveland, O.

Humason Mfg. Co., Forestville, Conn.

Miller Wire Spring Co., Bridgeport, Conn.

New York Wire & Spring Co., 586 Washington St., New York

Raymond Mfg. Co., Ltd., Corry, Pa.

### SPRINKLER SYSTEMS

General Fire Extinguisher Co., 277 W. Exchange St., Providence, R. I.

Globe Automatic Sprinkler Co., 2035 Washington Ave., Philadelphia, Pa.

Rockwood Sprinkler Co. of Mass., 34-56 Harlow St., Worcester, Mass.

### SPRINKLERS

#### —Automatic

Automatic Sprinkler Co. of America, 123 William St., New York

Globe Automatic Sprinkler Co., 2035 Washington Ave., Philadelphia, Pa.

PARKS-CRAMER CO., Fitchburg, Mass... *p. 636*

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\*SPRAY ENGINEERING CO., 93 Federal St., Boston, Mass... *pp. 134, 135*

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Cullman Wheel Co., 1344 Altgeld St., Chicago, Ill.

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Ehram & Sons Mfg. Co., J. B., Enterprise, Kan.

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 Turley Gear & Machine Co., 1505 N. 10th St., St. Louis, Mo.  
 Union Chain & Mfg. Co., Seville, O.  
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**SPUN SILK MANUFACTURING MACHINERY**

Franklin Machine Co., 189 Charles St., Providence, R. I.

**SQUEEZERS****—Foundry**

B & B Mfg. Co., Inc., P. O. Box 974, Indianapolis, Ind.

**—Puddling Mill**

Sterritt-Thomas Foundry Co., 32nd & Smallman Sts., Pittsburgh, Pa.

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Lebanon Boiler Works, Lebanon, Pa.

Leslie & Elliott Co., Cor. E. Railway & Iowa Ave., Paterson, N. J.

McAleenan Bros. Co., 25th & R. R. Sts., Pittsburgh, Pa.

McDermott Engineering Co., Whitehall & Jordan Sts., Allentown, Pa.

McNaull Boiler Mfg. Co., Toledo, O.

McNeill & Bro. Co., James, Pittsburgh, Pa.

Meehan Boiler & Construction Co., Lowellville, O.

Michelmann Steel Construction Co., 121-141 N. 2nd St., Quincy, Ill.

Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis.

Munroe & Sons, R., 23rd & Smallman Sts., Pittsburgh, Pa.

Muskegon Boiler Works, Muskegon, Mich.

New Haven Boiler Works, Mill St., New Haven, Conn.

Ohio Machine & Boiler Co., 1503 University St., Cleveland, O.

Pardel Corp'n, Bailey Bldg., Philadelphia, Pa.  
 Pennsylvania Boiler Works, 12th & Penna. Ave., Erie, Pa.

PETROLEUM IRON WORKS CO., Sharon, Pa. *pp. 672, 673*

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Pickham Boiler Co., 3035 W. Jackson Blvd., Chicago, Ill.

Pyne Co., 927 Rupp St., Louisville, Ky.

Reliance Boiler Works, 160 Marion St., Oshkosh, Wis.

Richmond Engineering Co., 12 S. 8th St., Richmond, Va.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

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Wholey Boiler Works, Providence, R. I.

Wilson Steam Boiler Co., 1919-27 S. 20th St., Omaha, Nebr.

Wm. Bros. Boiler & Mfg. Co., Minneapolis, Minn.

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Bridgeport Chain Co., 964 Crescent Ave., Bridgeport, Conn.

Bridgeport Metal Goods Mfg. Co., Cherry St., Bridgeport, Conn.

Bristol Brass Co., Bristol, Conn.

Cleveland Metal Products Co., 7609 Platt Ave., Cleveland, O.

The Cleveland Wrought Products Co., Cleveland, O.

Coleman Fare Box Co., 1191 Bathurst St., Toronto, Canada

Craig Mfg. Co., Cedar Rapids, Ia.

Cuyahoga Spring Co., Waterloo Road, Cleveland, O.

Detroit Pressed Steel Co., Detroit, Mich.

Foster, Merriam & Co., Meridan, Conn.

Gasket Supply Co., 1718 Ludlow St., Philadelphia, Pa.

Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

Gem Stopper Co., 2120 Nicholas St., Philadelphia, Pa.

Geuder, Paeschke & Frey Co., 1351 St. Paul Ave., Milwaukee, Wis.

Globe Mach. & Stamping Co., 1254 W. 76th St., Cleveland, O.

Great Western Mfg. Co., Laporte, Ind.

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 Mason Machine Co., Inc., Jos. M., 2305 N. Marshall St., Philadelphia, Pa.  
 Matthews Mfg. Co., 104 Gold St., Worcester, Mass.  
 Mossberg Co., Frank, Attleboro, Mass.  
 Nelson Mfg. Co., A., 2700 Southport Ave., Chicago, Ill.  
 Owen & Co., E. H., 101 N. Jefferson St., Chicago, Ill.  
 Parish Mfg. Co., 7th & Chestnut Sts., Reading, Pa.  
 Parker White Metal & Machine Co., Erie, Pa.  
 PRATT CHUCK CO., Frankfort, N. Y... *pp. 528, 529*  
 Ramsdell Specialty Co., W. Boylston St., Worcester, Mass.  
 \*REED & PRINCE MFG. CO., Worcester, Mass... *p. 539*  
 Risden Tool & Machine Co., Naugatuck, Conn.  
 Robbins Gamwell & Co., 68 West St., Pittsfield, Mass.  
 Robinson Tool Works, Inc., Waterbury, Conn.  
 Rockwood Sprinkler Co. of Mass., 34-56 Harlow St., Worcester, Mass.  
 Root Co., C. J., Bristol, Conn.  
 Transue & Williams Steel & Forging Corp'n, Alliance, O.  
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 Worcester Stamped Metal Co., 9 Hunt St., Worcester, Mass.  
 Zenite Metal Co., Indianapolis, Ind.

**STAMPS AND DIES, STEEL**

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 Matthews & Co., Jas H., 3942 Forbes St., Pittsburgh, Pa.  
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 Pannier Bros. Stamp Co., 207-209 Sandusky St., Pittsburgh, Pa.

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 CONNERY & CO., INC., 2nd & Luzerne Sts., Philadelphia, Pa... *p. 668*  
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**—Concrete**

Heine Chimney Co., 123 W. Madison St., Chicago, Ill.

**STARCH MAKING MACHINERY**

Remmers & Sons, B., 1227 Germantown Ave., Philadelphia, Pa.

**STAYBOLTS**

Falls Hollow Staybolt Co., 21 E. Portage St., Cuyahoga Falls, O.  
 Flannery Bolt Co., Vanadium Bldg., Pittsburgh, Pa.

**STEAM ENGINES, SEPARATORS, SHOVELS, TRAPS, Etc.**

(See Engines, Separators, Shovels, Traps, etc., Steam)

**STEAM JETS (Smoke Preventers)**

KROESCHELL BROS. CO., 460 West Erie St., Chicago, Ill... *p. 58*

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American Manganese Steel Co., 1851 McCormick Bldg., Chicago, Ill.

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 D'ESTE CO., JULIAN, 28 Canal St., Boston, Mass... *pp. 166, 167*  
 Griscom-Russell Co., 90 West St., New York  
 Hennebohle Co., F., 81st St. & S. Chicago Ave., S. Chicago, Ill.  
 \*ILLINOIS ENGINEERING CO., Racine Ave. at 21st St., Chicago, Ill... *pp. 170, 171, 172*  
 \*JOHNS-MANVILLE CO., H. W., 296 Madison Ave., New York... *p. 200*  
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 McAlear Mfg. Co., 1901 S. Western Ave., Chicago, Ill.  
 Mechanical Scale Prevention Co., 65 Day St., New York  
 National Steam Specialty Co., 12-14 S. Clinton St., Chicago, Ill.  
 Nightingale & Childs Co., 205 Congress St., Boston, Mass.  
 Open Coil Heater & Purifier Co., Indianapolis, Ind.  
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 Pitts & Kitts Mfg. & Supply Co. (Bondite), 50 Park Place, N. Y. C.  
 Ross Valve Mfg. Co., Troy, N. Y.  
 SIMMONS CO., JOHN, 110 Center St., New York... *p. 229*  
 Sterling Products Co., Inc., Harvard Sq., Cambridge, Mass.  
 Watts Regulator Co., 250-252 Lowell St., Lawrence, Mass.  
 Wilcox Mfg. Co., E. A., Chicago, Ill.

**STEEL****—Alloy**

Aborn Steel Co., Inc., 22 Clarke St., N. Y. C.  
 Atlas Crucible Steel Co., Dunkirk, N. Y.  
 Becker Steel Co. of America, Inc., 154 Nassau St., New York  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Cyclops Steel Co., Inc., 120 Broadway, New York  
 Denman & Davis, 93-99 Lafayette St., New York  
 Electro Steel Co., Inc., 206 Jones Bldg., Federal Tool & Alloy Steel Corp'n, Woolworth Bldg., N. Y. C.  
 Halcomb Steel Co., Syracuse, N. Y.  
 Hess Steel Corp'n, East Ave. & P. R. R., Baltimore, Md.  
 Interstate Iron & Steel Co., 104 S. Michigan Ave., Chicago, Ill.  
 Ludlum Steel Co., 2 Rector St., New York  
 Union Electric Steel Co., 208 Keystone Bldg., Pittsburgh, Pa.  
 United Alloy Steel Corp'n, Canton, O.  
 Vanadium Alloys Steel Co., Latrobe, Pa.  
 Vulcan Crucible Steel Co., Aliquippa, Pa.  
 WHEELOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... *p. 410*

**—Alloy (Gold Drawn)**

Lancaster Steel Products Co., Lancaster, Pa.  
 Pittsburgh Tool Steel Wire Co., Monaca, Pa.  
 \*UNION DRAWN STEEL CO., Beaver Falls, Pa... *p. 408*

**—Bar**

Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.  
 Interstate Iron & Steel Co., 104 S. Michigan Ave., Chicago, Ill.  
 Lockhart Iron & Steel Co., Pittsburgh, Pa.  
 Pardee Works, C., Perth Amboy, N. J.  
 Standard Screw Products Co., Bellevue & Warren Ave., Detroit, Mich.  
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**—Chrome Nickel**

Andrews Steel Co., Newport, Ky.

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**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
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 Lindenberg Steel Co., 90 West St., New York  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 Union Steel Casting Co., Pittsburgh, Pa.  
 —**Cold Drawn**  
 Dickey Steel Co., Inc., 233 Broadway, New York  
 Fitzsimmons Co., Youngstown, O.  
 Kidd Drawn Steel Co., Aliquippa, Pa.  
 Moltrup Steel Products Co., Beaver Falls, Pa.  
 New England Drawn Steel Co., Mansfield, Mass.  
 Standard Gauge Steel Co., Beaver Falls, Pa.  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 WORCESTER PRESSED STEEL CO., Worcester, Mass... *p. 414*  
 —**Cold Rolled**  
 Athenia Steel Co., 135 William St., New York  
 Bliss & Laughlin, Inc., Harvey, Ill.  
 Carpenter Steel Co., Reading, Pa.  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 —**Crucible**  
 Atlas Crucible Steel Co., Dunkirk, N. Y.  
 Braeburn Steel Co., Braeburn, Pa.  
 Century Steel Co. of America, 120 Broadway, New York  
 Ludlum Steel Co., 2 Rector St., New York  
 McInnes Steel Co., Ltd., Corry, Pa.  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 —**Crucible (Cold Drawn)**  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 —**Electric Furnace**  
 Braeburn Steel Co., Braeburn, Pa.  
 Electro Steel Co., Inc., 206 Jones Bldg., Pittsburgh, Pa.  
 Gerlinger Steel Castings Co., Milwaukee, Wis.  
 Hess Steel Corp'n, East Ave. & P. R. R., Baltimore, Md.  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 Union Electric Steel Co., 206 Keystone Bldg., Pittsburgh, Pa.  
 United Alloy Steel Corp'n, Canton, O.  
 —**High Speed**  
 Aborn Steel Co., Inc., 22 Clarke St., N. Y. C.  
 Allen & Co., Ltd., Edgar, 718-22 West Lake St., Chicago, Ill.  
 Andrew & Co., Ltd., Kno. Hy., 26 Cortlandt St., New York  
 Apex Steel Corp'n, 50 Church St., New York  
 Atlas Crucible Steel Co., Dunkirk, N. Y.  
 Becker Steel Co. of America, Inc., 154 Nassau St., New York  
 Century Steel Co. of America, 120 Broadway, New York  
 Colonial Steel Co., 324 Fourth Ave., Pittsburgh, Pa.  
 Columbia Tool Steel Co. (Clarite), Chicago Heights, Ill.  
 Cyclops Steel Co., 120 Broadway, New York  
 Denman & Davis, 93-99 Lafayette St., New York  
 Dickey Steel Co., Inc., 233 Broadway, New York  
 Firth-Sterling Steel Co., McKeesport, Pa.  
 Halcomb Steel Co., Syracuse, N. Y.  
 Haynes Stellite Co., Kokomo, Ind.  
 Hobson, Houghton & Co., Ltd., 83 Beekman St., New York  
 Jessop & Sons, Inc., Wm., 91 John St., New York
- Lindenberg Steel Co., 90 West St., New York  
 McInnes Steel Co., Ltd., Corry, Pa.  
 Metro Steel Co., Wabash Bldg., Pittsburgh, Pa.  
 Vanadium Alloys Steel Co. (Red Cut Superior), Latrobe, Pa.  
 Vulcan Crucible Steel Co., Aliquippa, Pa.  
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 WHEELLOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... *p. 410*  
 —**Magnet**  
 Atlas Crucible Steel Co., Dunkirk, N. Y.  
 Lindenberg Steel Co., 90 West St., New York  
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 WHEELLOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... *p. 410*  
 —**Manganese**  
 American Manganese Steel Co., 1850 McCormick Bldg., Chicago, Ill.  
 Taylor-Wharton Iron & Steel Co., High Bridge, N. J.  
 —**Nickel**  
 Andrew & Co., Ltd., Jno. Hy., 26 Cortlandt St., New York  
 Lindenberg Steel Co., 90 West St., New York  
 —**Open Hearth**  
 Atlas Steel Casting Co., 1963 Elmwood Ave., Buffalo, N. Y.  
 Braddock Mfg. Co., Braddock, Pa.  
 FALK CO., Milwaukee, Wis... *pp. 262, 263*  
 Jones & Laughlin Steel Co., 3rd Ave. & Ry., Pittsburgh, Pa.  
 LUKENS STEEL CO., Coatesville, Pa... *p. 77*  
 Pittsburgh Steel Co., Union Arcade Bldg., Pittsburgh, Pa.  
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 United Alloy Steel Corp'n, Canton, O.  
 WHEELLOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... *p. 410*  
 —**Open Hearth (Cold Drawn)**  
 Columbia Steel & Shafting Co., Pittsburgh, Pa.  
 Compressed Steel Shafting Co., 393 Dorchester Ave., Boston, Mass.  
**\*UNION DRAWN STEEL CO.**, Beaver Falls, Pa... *p. 408*  
 —**Rock Drill**  
 Colonial Steel Co., 324 Fourth Ave., Pittsburgh, Pa.  
 —**Shim**  
 Barnes Co., Wallace, Main St., Bristol, Conn.  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 —**Spring**  
 Athenia Steel Co., 135 William St., New York  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 Wyoming Shovel Works, Wyoming, Pa.  
 —**Spring (Cold Rolled)**  
 Barnes Co., Wallace, Main St., Bristol, Conn.  
 —**Stellite**  
 Haynes Stellite Co., Kokomo, Ind.  
 —**Strip**  
 American Tube & Stamping Co., Bridgeport, Conn.  
 Blum & Co., Julius, 532-40 W. 22nd St., New York  
 Central Steel & Wire Co., 119 N. Peoria St., Chicago, Ill.  
 Lancaster Steel Products Co., Lancaster, Pa.  
 WARD'S SONS, EDGAR T., Boston, Mass. *p. 409*  
 WORCESTER PRESSED STEEL CO., Worcester, Mass... *p. 414*  
 —**Strip (Hot Rolled)**  
 American Tube & Stamping Co., Bridgeport, Conn.  
 —**Strip (Tempered and Blued)**  
 Barnes Co., Wallace, Main St., Bristol, Conn.  
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## —Structural

Bergen Point Iron Works, West 8th St., Bayonne, N. J.  
 Cincinnati Iron & Steel Co., Cincinnati, O.  
 Continental Bridge Co., Peotone, Ill.  
 Dominion Bridge Co., Limited, Montreal, Que.  
 Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.  
 Minneapolis Steel & Machinery Co., 29th & Minnehaha Ave., Minneapolis, Minn.  
 Rownson Drew & Clydesdale, Inc., 68 William St., New York

## —Tool

Allen & Co., Ltd., Edgar, 718-22 West Lake St., Chicago, Ill.  
 Andrew & Co., Ltd., Jno. Hy., 26 Cortlandt St., New York  
 Apex Steel Corp'n, 50 Church St., New York  
 Atlas Crucible Steel Co., Dunkirk  
 Becker Steel Co. of America, Inc., 154 Nassau St., New York  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Century Steel Co. of America, 120 Broadway, New York  
 Colonial Steel Co., 324 4th Ave., Pittsburgh, Pa.  
 Columbia Tool Steel Co. (Columbia), Chicago Heights, Ill.  
 Cyclops Steel Co., 120 Broadway, New York  
 Denman & Davis, 93-99 Lafayette St., New York  
 Dickey Steel Co., Inc., 233 Broadway, New York  
 Electro Steel Co., Inc., 206 Jones Bldg., Pittsburgh, Pa.  
 Federal Tool & Alloy Steel Corp'n, Woolworth Bldg., N. Y. C.  
 Firth-Sterling Steel Co., McKeesport, Pa.  
 Halcomb Steel Co., Syracuse, N. Y.  
 Haynes Stellite Co., Kokomo, Ind.  
 Hess Steel Corp'n, East Ave. & P. R. R., Baltimore, Md.  
 Hobson, Houghton & Co., Ltd., 83 Beekman St., New York  
 International High Speed Steel Co. (International), Rockaway, New Jersey  
 Jessop & Sons, Inc., Wm., 91 John St., New York  
 Kidd Drawn Steel Co., Aliquippa, Pa.  
 Lindenbergh Steel Co., 90 West St., New York  
 Metro Steel Co., Wabash Bldg., Pittsburgh, Pa.  
 Pittsburgh Tool Steel Wire Co., Monaca, Pa.  
 RYERSON & SON, JOSEPH T., 16th & Rockwell Sts., Chicago, Ill. . . p. 482  
 Vulcan Crucible Steel Co., Aliquippa, Pa.  
 WARD'S SONS CO., EDGAR T., Boston, Mass. . . p. 409  
 WHEELLOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass. . . p. 410

## —Vanadium

Union Steel Casting Co., Pittsburgh, Pa.

**STEEL BARS, BILLETS, BLOOMS, DISCS, SLABS, SHEETS, ETC.**

(See Bars, Billets, Blooms, Discs, Slabs, Sheets, etc., Steel)

**STEEL PLATE CONSTRUCTION**

Bartlett Hayward Co., Baltimore, Md.  
 Bergen Point Iron Works, West 8th St., Bayonne, N. J.  
 BIGGS BOILER WORKS CO., Case Ave. & Newton St., Akron, Ohio. . . pp. 666, 667  
 Birmingham Boiler Works, Birmingham, Ala.  
 Borger Bros., 257 W. Spring St., Columbus, O.  
 BASS FOUNDRY & MACHINE CO., Fort Wayne, Ind. . . p. 39  
 \*BIGELOW CO., 76 River St., New Haven, Conn. . . p. 46  
 Burhorn Co., Edwin, 25 West Broadway, New York  
 CALDWELL CO., INC., W. E., 340 E. Brandeis St., Louisville, Ky. . . p. 280  
 \*CAMDEN IRON WORKS, Camden, N. J. . . p. 609  
 Carroll-Porter Boiler & Tank Co., Pittsburgh, Pa.

\*COLE MFG. CO., R. D., Newnan, Ga. . . p. 47  
 CONNERY & CO., INC., 2nd & Luzerne Sts., Philadelphia, Pa. . . p. 668  
 Cunningham Co., Christopher, Greenpoint Ave. & Newton Creek, Brooklyn, N. Y.  
 DILLON STEAM BOILER WORKS, D. M., Fitchburg, Mass. . . pp. 50, 51  
 Dominion Bridge Co., Ltd., Montreal, Quebec.  
 Dover Boiler Works, 50 Church St., New York  
 Duff Patents Co., Inc., 918 Frick Bldg., Pittsburgh, Pa.  
 Enterprise Boiler Co., Youngstown, O.  
 FROST MFG. CO., 112 W. Adams St., Chicago, Ill. . . pp. 53, 654  
 Furman-Fisher Corp'n., 30 Church St., N. Y. C.  
 Gerdes Co., Inc., 30 Church St., New York  
 Gillespie Mfg. Corp'n, 12th & Monmouth Sts., Jersey City, N. J.  
 GRAVER TANK WORKS, WM., East Chicago, Ind. . . p. 120  
 Hammond Iron Works, Warren, Pa.  
 \*HEINE SAFETY BOILER CO., St. Louis, Mo. . . p. 54  
 Hodge Boiler Works, 99 Sumner St., East Boston, Mass.  
 HOLMES & BROS., ROBT., Danville, Ill. . . p. 380  
 \*KEELER CO., E., Williamsport, Pa. . . p. 55  
 Kittoe Boiler & Tank Co., Inc., Canton, O.  
 KOVEN & BROTHER, L. O., 154 Ogden Ave., Jersey City, N. J. . . p. 628  
 Lebanon Boiler Works, Lebanon, Pa.  
 Lookout Boiler & Mfg. Co., Chattanooga, Tenn.  
 McAleenan Bros. Co., 25th & R. R. Sts., Pittsburgh, Pa.  
 McClintic-Marshall Co., 1217 Oliver Bldg., Pittsburgh, Pa.  
 McNeil & Bro. Co., James, 29th St. & A. V. R. R., Pittsburgh, Pa.  
 MARK MFG. CO., P. O. Box G, Chicago, Ill. . . p. 197  
 Meehan Boiler & Construction Co., Lowellville, O.  
 Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis.  
 MILWAUKEE RELIANCE BOILER WORKS, Milwaukee, Wis. . . p. 123  
 Mohr & Scns, John, 349-359 W. Illinois St., Chicago, Ill.  
 Munroe & Sons, R., 23rd & Smallman Sts., Pittsburgh, Pa.  
 Muskegon Boiler Works, Muskegon, Mich.  
 New Haven Boiler Works, Mill St., New Haven, Conn.  
 New York Central Iron Works Co., Box 66, Hagerstown, Md.  
 Ohio Machine & Boiler Co., 1503 University St., Cleveland, O.  
 PETROLEUM IRON WORKS CO., Sharon, Pa. . . pp. 672, 673  
 PHOENIX IRON WORKS CO., Meadville, Pa. . . p. 671  
 Pickham Boiler Co., 3035 W. Jackson Blvd., Chicago, Ill.  
 Pollock Co., Wm. B., Youngstown, O.  
 Prospect Boiler Co., Ward St. & Raritan River R. R., New Brunswick, N. J.  
 Ritter-Conley Co., Pittsburgh, Pa.  
 Ruemmeli-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.  
 Sharpville Boiler Works Co., Sharpville, Pa.  
 Smith & Son Co., Samuel, 130-150 Railroad Ave., Paterson, N. J.  
 Struthers-Wells Co., Warren, Pa.  
 Thora Co., J. S., 20th & Allegheny Ave., Philadelphia, Pa.  
 Treadwell Const. Co., Midland, Pa.  
 Turl Iron & Car Co., Inc., 50 Broad St., New York  
 Union Boiler & Mfg. Co., Lebanon, Pa.  
 \*UNION IRON WORKS, Erie, Pa. . . p. 68  
 Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.  
 WALSH & WEIDNER BOILER CO., Chattanooga, Tenn. . . p. 69

**STEEL TEMPERING (Refrigeration)**

Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.

**STEEL TESTING APPARATUS**

BROWN INSTRUMENT CO., Philadelphia, Pa...*p. 247*

Holz, Herman A., 1 Madison Ave., New York

**STEEL TREATING**

Connecticut Metal Treating Co., Inc., 207

Knowlton St., Bridgeport, Conn.

WILLIAMS & CO., J. H., 70 Richards St.,

Brooklyn, N. Y...*p. 530*

**STEEL WORKS EQUIPMENT**

Blair Engineering Co., 17 Battery Place, New York

Diamond Machine Co., Monongahela, Pa.

Mackintosh Hemphill & Co., 12th & Etna Sts., Pittsburgh, Pa.

Morgan Engineering Co., Alliance, O.

Reliance Steel Casting Co., 28th & Smallman Sts., Pittsburgh, Pa.

United Engineering & Foundry Co., Farmers Bank Bldg., Pittsburgh, Pa.

**STEEPLE TOWERS (Coal)**

\*LINK-BELT CO., Philadelphia, Pa...*p. 341*

Maine Electric Co., 35 Commercial St., Portland, Me.

**STEERING GEARS****—Automobile**

Lavine Gear Co., Racine, Wis.

VAN DORN & DUTTON CO., Cleveland, O...*p. 495*

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Lavine Gear Co., Racine, Wis.

**STEPS, LADDER & STAIR (Non-Shipping)**

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**—Gasoline**

Boufsman Mfg. Co., Inc., 1157-9 Plainfield Ave., N. E., Grand Rapids, Mich.

**—Hydrogen Water**

\*INTERNATIONAL OXYGEN CO., 796 Frelinghuysen Ave., Newark, N. J...*p. 567*

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McAleenan Bros. Co., 25th & R. R. Sts., Pittsburgh, Pa.

MARSHALL FOUNDRY CO., 1st Natl. Bank Bldg., Pittsburgh, Pa...*p. 670*

\*UNITED STATES CAST IRON PIPE & FDRY. CO., Burlington, N. J...*p. 191*

**—Water**

American Water Softener Co., 1011 Chestnut St., Philadelphia, Pa.

CONNERY & CO., INC., 2nd and Luzerne Sts., Philadelphia, Pa...*p. 668*

Hodges Water Still Co., Inc., 911 Pennsylvania Bldg., Philadelphia, Pa.

\*INTERNATIONAL OXYGEN CO., 796 Frelinghuysen Ave., Newark, N. J...*p. 567*

KOVEN & BROTHER, L. O., 154 Ogden Ave., Jersey City, N. J...*p. 628*

Standard Water Systems Co. (Tripure), Hampton, N. J.

\*UNITED STATES CAST IRON PIPE & FDRY. CO., Burlington, N. J...*p. 191*

**—Welded**

Kellogg Co., M. W., 90 West St., New York

**STOCKS AND DIES**

Bay State Tap & Die Co., Mansfield, Mass.

BORDEN CO. (Beaver), Warren, O...*p. 502*

Carpenter Tap & Die Co., J. M., Pawtucket, R. I.

\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill...*pp. 138, 139, 140, 141*

\*GREENFIELD TAP & DIE CORP'N, Greenfield, Mass...*pp. 500, 501*

Hart Mfg. Co., 2315 E. 20th St., Cleveland, O.

\*LANDIS MACHINE CO., INC., Waynesboro, Pa...*pp. 498, 499*

MARK MFG. CO., P. O. Box G, Chicago, Ill...*p. 197*

Oster Mfg. Co., 2057 E. 61st Place, Cleveland, O.

Pottstown Machine Co., Pottstown, Pa.

PRATT & WHITNEY CO., 111 Broadway, New York...*p. 461*

Reed Mfg. Co., Erie, Pa.

Toledo Pipe Threading Machine Co. (Toledo), 1445 Summit St., Toledo, O.

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AUTOMATIC FURNACE CO., Dayton, O...*pp. 92, 93*

\*BABCOCK & WILCOX CO., 85 Liberty St., New York...*pp. 40, 41, 42, 43*

Babcock & Wilcox Ltd., College St., St. Henry, Montreal, Canada

BRADY FOUNDRY CO., JAMES A., 4524 Western Blvd., Chicago, Ill...*p. 85*

Burke Furnace Co., 223 W. Austin Ave., Chicago, Ill.

Crowe, Paul L., 33 Bidwell Ave., Jersey City, N. J.

Green Engineering Co., East Chicago, Ind.

\*ILLINOIS STOKER CO., Alton, Ill...*p. 95*

Keystone Stoker Co., Greenfield, Mass.

Laclede-Christy Clay Products Co., 1673 Ry. Exchange Bldg., St. Louis, Mo.

Manistee Iron Works Co., Manistee, Mich.

Rosedale Fndry. & Mach. Co. (Playford), Columbus & Preble Aves., North Side, Pittsburgh, Pa.

United Stokers Corp'n, 1500 Ola Colony Bldg., Chicago, Ill.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa...*pp. 128, 129*

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Armstrong Mfg. Co., Springfield, O.

Cokal Stoker Co., 1029-31 N. Clark St., Chicago, Ill.

Files Engrg. Co., Inc., Providence, R. I.

FLYNN & EMRICH CO., Baltimore, Md...*p. 101*

Hofft Co., M. A., Indianapolis, Ind.

MARION MACHINE FOUNDRY & SUPPLY CO., Marion, Ind...*p. 106*

Mershon Patent Shaking Grate Works, 147 N. Third St., Philadelphia, Pa.

Perfection Grate & Supply Co. (Perfection), 164 Birnie Ave., Springfield, Mass.

**—Locomotive**

Locomotive Stoker Co., Robinson & Darrah Sts., Northside, Pittsburgh, Pa.

\*PULVERIZED FUEL EQUIPMENT CORP'N, 30 Church St., New York...*p. 108*

Standard Stoker Co., Grand Central Terminal, New York

STROUD & CO., E. H., 928-934 Fullerton Ave., Chicago, Ill...*pp. 622, 623*

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AUTOMATIC FURNACE CO., Dayton, O...*pp. 92, 93*

Burke Furnace Co., 223 W. Austin Ave., Chicago, Ill.

\*CASEY-HEDGES CO., Chattanooga, Tenn...*pp. 48, 49*

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DETROIT STOKER CO., Detroit, Mich...*p.*  
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McCLAVE-BROOKS CO. (McClave's), Scranton, Pa...*p.* 103

McKenzie Furnace Co., 647 McCormick Bldg., Chicago, Ill.

McMillan & Co., James, 114 Clarkson Court, Chicago, Ill.

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Michelmann Steel Construction Co., 121-141 N. Second St., Quincy, Ill.

Nazareth Foundry & Machine Co., Nazareth, Pa.

Phoenix Iron Co., 22 So. 15th St., Philadelphia, Pa.

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Torrington Co. (Dayton), Torrington, Conn.

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Bethlehem Steel Co., Bethlehem, Pa.

**SWITCHBOARDS**

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International Engineering Works, Inc., Framingham, Mass.  
Johnson & Barry Steel Co., Inc., Birmingham, Ala.  
Kaw Boiler Works Co., Kansas City, Mo.  
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McAleenan Bros. Co., 25th & R. R. Sts., Pittsburgh, Pa.  
McDermott Engineering Co., Whitehall & Jordan Sts., Allentown, Pa.  
McNaull Boiler Mfg. Co., Toledo, O.  
McNeil & Bro. Co., James, 29th St. & A. V. R. R., Pittsburgh, Pa.  
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New York Central Iron Works Co., Box 66, Hagerstown, Md.  
Newbold & Son Co., R. S., Norristown, Pa.  
Ohio Machine & Boiler Co., 1503 University St., Cleveland, O.  
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Prospect Boiler Co., Ward St. & Raritan River R. R., New Brunswick, N. J.  
Pyne Co., 927 Rupp St., Louisville, Ky.  
Reeves Bros. Co., Box K, Alliance, O.  
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Smith & Son Co., Samuel, 130-150 Railroad Ave., Paterson, J. N.  
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Treadwell Construction Co., Midland, Pa.  
Turl Iron & Car Co., Inc., 50 Broad St., New York  
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Warren City Tank & Boiler Co., Warren, O.  
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 Allen Mfg. Co., 135 Sheldon St., Hartford, Conn.  
**TAPPING AND VALVE INSERTING MACHINES (Water)**  
 Lennox Machine Co., 2553 W. 16th St., Chicago, Ill.  
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 Allen Machine Co., 1585 Columbus Rd., N. W., Cleveland, Ohio  
 Brown, CO., H. B., East Hampton, Conn.  
 Burke Machine Tool Co., Conneaut, O.  
 Evans Stamping & Plating Co. (Tuttle), Cushman St., Taunton, Mass.  
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 Meriden Machine Tool Co., Meriden, Conn.  
 Partridge, E. O., 2047-2049 W. Lake St., Chicago, Ill.  
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 St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo.  
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 Webster & Perks Tool Co., 300 Center St., Springfield, O.

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 American Tap & Die Co., Greenfield, Mass.  
 Bay State Tap & Die Co., Mansfield, Mass.  
 Brubaker & Bros., W. L., 50 Church St., New York  
 Butterfield & Co., Derby Line, Vt.  
 Card Mfg. Co., S. W., Rumford Ave., Mansfield, Mass.  
 Carpenter Tap & Die Co., J. M., Pawtucket, R. I.  
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 Morse Twist Drill & Machine Co., New Bedford, Mass.  
 Murchey Machine & Tool Co., 85 Porter St., Detroit, Mich.  
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 Russell Mfg. Co., Greenfield, Mass.  
 Standard Tool Co., 6900 Central Avenue, Cleveland, Ohio  
 Sterling Products Co., Inc., 549 Washington Blvd., Chicago, Ill.  
 Winter Bros. Co., Wrentham, Mass.  
**TAPS, COLLAPSING**  
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Rickert-Shafer Co., 613 W. 11th St., Erie, Pa.  
 Victor Tool Co., Waynesboro, Pa.

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Koppers Co., H., Union Arcade, Pittsburgh, Pa.

### TELPHERS

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### TEMPERATURE REGULATORS

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### TESTING MACHINES

Emery, A. H., Maple Ave., Glenwood, Conn.

Holz, Herman A., 1 Madison Ave., New York

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Perkins, Henry F., 46 Walnut Ave., Andover,

Mass.

Rice, Barton & Fales Machine & Iron Co.,

Worcester, Mass.

Text Corp'n, Bay State Bldg., Lawrence, Mass.

Tillotson Humidifier Co., Providence, R. I.

Trump Bros. Machine Co., Beech & Anchorage

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National Gauge Co., 300 Pacific St., Brooklyn,

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Palmer Co., 114-116 W. Sixth St., Cincinnati, O.

Precision Thermometer & Instrument Co.,

1434 Brandywine St., Philadelphia, Pa.

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Wagner, Carl H., 1944 W. Albany Ave., Chicago,  
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Weinhagen & Hespe, 159-165 Leonard St.,  
 N. Y. C.

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Leeds & Northrup Co., 4901 Stenton Ave.,

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Thwing Instrument Co., 3339 Lancaster Ave.,

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### —Distance (Vapor Tension)

National Gauge & Equipment Co., La Crosse,

Wis.

### —Electric

Thwing Instrument Co., 3339 Lancaster Ave.,

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Thermograde Valve Co., Howard St., Water-

town, Mass.

### —Electric

American Thermostat Co., 101 Mechanic St.,

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Johnson Service Co., Milwaukee, Wis.

### —Pneumatic

Johnson Service Co., Milwaukee, Wis.

**POWERS REGULATOR CO.**, 972 Architects

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### THREAD CUTTING TOOLS

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Webster & Perks Tool Co., 300 Center St.,

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 \*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio... *pp.* 344, 345  
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**TIES, STEEL** (Mine)

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Maurer & Son, Henry, 420 E. 23rd St., New York

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 Bethlehem Steel Co., Bethlehem, Pa.  
 LaBelle Iron Works, Steubenville, O.

**TINSMITHS' MACHINERY**

Dreis Krump Mfg. Co., 2919 So. Halsted St., Chicago, Ill.

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Williams Foundry & Machine Co., Akron, O.

**TIRE SETTING MACHINES** (Hydraulic)  
 West Tire Setter Co., Rochester, N. Y.

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Edgewater Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.  
 Railway Steel Spring Co., 30 Church St., New York

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American Machine & Foundry Co., 250 Second Ave., Brooklyn, N. Y.  
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 Porter-Cable Machine Co., 1708 N. Salina St., Syracuse, N. Y.  
 Rickert-Shafer Co., 613 W. 11th St., Erie, Pa.  
 Rogers Works, Inc., John M., Gloucester City, N. J.  
 Schellenbach-Hunt Tool Co., 120 Opera Place, Cincinnati, O.  
 Union Tool Co., Orange, Mass.

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Oldham & Son Co., George, 4316-22 Tacka-  
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—**Special**

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Detroit Reamer & Tool Co., 302 Congress St., E.,  
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Diamond Tool & Mfg. Co., 91-97 Runhon St.,  
Newark, N. J.

Dove-Smith & Son., Niagara Falls, N. Y.  
Elgin Tool Works, Elgin, Ill.

Fraser Co., Warren F., 81 Freeport St., Boston,  
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Ulmer Co., J. C., 1791 E. 38th St., Cleveland O.  
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—**Wood Working**  
Greenlee Bros. & Co., Rockford, Ill.  
Stanley Rule & Level Co., New Britain, Conn.

**TORCHES**  
Gem Mfg. Co., 1229-43 Goebel St., N. S., Pitts-  
burgh, Pa.

Hauck Mfg. Co., 101 11th St., Brooklyn, N. Y.  
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North American Mfg. Co., 5902 Carnegie Ave.,  
Cleveland, O.

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—**Welding and Cutting**  
Bastian-Blessing Co., W. Austin Ave. at La  
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 Brunner Machinery Co., Fisher Bldg., Chicago, Ill.  
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 Indiana  
 Burrell Mfg. & Supply House, Kankakee, Ill.  
 Case Threshing Machine Co., J. I., Racine, Wis.  
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 Holt Mfg. Co., Stockton, Cal.  
 Imperial Machine Co. (Imperial Forty), 1611  
 Central Ave., Minneapolis, Minn.  
 Iawson Mfg. Co., John, New Holsten, Wis.  
 Minneapolis Steel & Machinery Co., 29th &  
 Minnehaha Ave., Minneapolis, Minn.  
 National Tractor Co., Cedar Rapids, Ia.  
 Reliable Engine Co. (Reliable), Portsmouth, O.  
 Russell & Co., 814 S. Erie St., Massillon, O.  
 Staude Mfg. Co., E. G., 2675 University Ave.,  
 St. Paul, Minn.  
 Union Tool Co., Torrance, Cal.  
 Wallis Tractor Co., Racine, Wis.  
 Waterloo Gasoline Engine Co., Waterloo, Ia.  
 West Coast Steel Co., 21st & Pacific Sts., Ta-  
 coma, Wash.  
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Cleveland Tractor Co., Cleveland, O.  
 Crescent Truck Co., 347-349 First Ave., Eliza-  
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Broderick & Bascom Rope Co., 805 N. Main St.,  
 St. Louis, Mo.

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 Detroit Gear & Machine Co., 127-151 Franklin  
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Grant-Lees Gear Co., 2367 E. 69th St., Cleve-  
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Warner Gear Co., Muncie, Ind.

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Evans Stamping & Plating Co. (Paragon),  
 Cushman St., Taunton, Mass.

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—**Tractor**

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## —Condenser

Farnsworth Co., Conshohocken, Pa.  
Morehead Mfg. Co., 1041 Grand River Ave.,  
Detroit, Mich.

## —Radiator

Armstrong Machine Works, Three Rivers, Mich.  
D. G. C. Trap & Valve Co., 18 E. 41st St., New  
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Barton, John W., 2707 Vestry Ave., Cleveland, O.

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Boylston Steam Specialty Co., 116 W. Illinois  
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Lytton Mfg. Corp'n, Franklin, Va.

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Morehead Mfg. Co., Detroit, Mich.

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Nicholson & Co., W. H., Wilkes-Barre, Pa.

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 Holyoke Truck Co., 102 Race St., Holyoke, Mass.  
 Lewis-Shepard Co., 48 Binford St., Boston, Mass.  
 National Scale Co., Chicopee Falls, Mass.  
 Plimpton Truck Sales Office, 70 Fifth Ave., New York  
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 Chase Foundry & Mfg. Co., Columbus, O.  
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Menasha Wood Split Pulley Co., Menasha, Wis.  
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\*HUNT CO., INC., C. W., West New Brighton, Staten Island, N. Y...*pp. 342, 343*

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American Pipe Bending Machine Co., 46 Pearl St., Boston, Mass.  
 Cox Engrg. & Tube Bending Machine Works, J. Fillmore, 681-687 Boulevard, Bayonne, N. J.

**TUBE CLEANERS**—**Boiler**

Bushnell & Co., John S., 146 Liberty St., New York

Chesterton Co., A. W., 64 India St., Boston, Mass.

Dallett Co., Thomas H., Broad & Federal Sts., Philadelphia, Pa.

General Specialty Co., 291-295 Michigan Ave., Buffalo, N. Y.

Lagonda Mfg. Co., Springfield, O.  
 Liberty Mfg. Co., 6900 Susquehanna St., Pittsburgh, Pa.

Manchester Mfg. Co., North Manchester, Ind.  
 The Paul B. Huyette Co., Inc. (Tornado), 5 So. 18th St., Phila., Pa.

PIERCE CO., WM. B., 45 North Division St., Buffalo, N. Y...*p. 81*

Rosedale Fndry. & Mach. Co., Columbus & Freble Aves., North Side, Pittsburgh, Pa.

Roto Co., Hartford, Conn.  
 Sherwood Mfg. Co., 1702-1712 Elmwood Ave., Buffalo, N. Y.

Thompson & Co., Richard, 126 Liberty St., New York

—**Condenser**

Roto Co., Hartford, Conn.

—**Economizer**

Roto Co., Hartford, Conn.

**TUBE DRAWING MACHINERY**

Richard Mfg. Co., Bloomburg, Pa.

**TUBE EXTRACTORS, BOILER**

Robertson Co., John F., 1001 Park Bldg., Pittsburgh, Pa.

**TUBE MILL MACHINERY**\*LANDIS MACHINE CO., INC., Waynesboro, Pa...*pp.* 498, 499PHOENIX IRON WORKS CO., Meadville, Pa.  
...*p.* 671TORRINGTON MFG. CO., Torrington, Conn...  
...*p.* 645**—Seamless**

Standard Engineering Co., Ellwood City, Pa.

**TUBE ROLLING MACHINES**BRISTOL MACHINE TOOL CO., Bristol, Conn...*pp.* 474, 475**TUBE TAPERING MACHINES**

Torrington Co., Torrington, Conn.

**TUBE WORKS EQUIPMENT**\*LANDIS MACHINE CO., INC., Waynesboro, Pa...*pp.* 498, 499TORRINGTON MFG. CO., Torrington, Conn.  
...*p.* 645**TUBES****—Boiler**

Allegheny Steel Co., Pittsburgh, Pa.

Best Co., Arvott Bldg., Pittsburgh, Pa.

Detroit Seamless Steel Tube Co., 841 Jefferson Ave., West Detroit, Mich.

MARK MFG. CO., P. O. Box G, Chicago, Ill...  
...*p.* 197

Midvale Steel &amp; Ordnance Co., Widener Bldg., Philadelphia, Pa.

National Tube Co (National), Frick Bldg., Pittsburgh, Pa.

Parkesburg Iron Co., Parkesburg, Pa.

Pittsburgh Steel Products Co., Union Arcade Bldg., Pittsburgh, Pa.

Reliance Tube Co., Ltd., 803 Second National Bank Bldg., Pittsburgh, Pa.

South Chester Tube Co., Chester, Pa.

Stirling, Allan, 878 Drexel Bldg., Philadelphia, Pa.

Tyler Tube and Pipe Co., Washington, Pa.

**—Boiler (Charcoal Iron)**

Parkesburg Iron Co., Parkesburg, Pa.

Reading Iron Co., Reading, Pa.

Tyler Tube &amp; Pipe Co., Washington, Pa.

**—Boiler (Ingot Iron)**MONONGAHELA TUBE CO., Pittsburgh, Pa.  
...*p.* 78**—Boiler (Seamless Steel)**

Blum &amp; Co., Julius, 532-40 W. 22nd St., New York

Detroit Seamless Steel Tube Co., 841 Jefferson Ave., West, Detroit, Mich.

Reading Iron Co., Reading, Pa.

Standard Seamless Tube Co., Ambridge, Pa.

**—Boiler (Soft Steel)**

Tyler Tube &amp; Pipe Co., Washington, Pa

**—Condenser**AMERICAN BRASS CO., Waterbury, Conn...  
...*p.* 401

Baltimore Tube Co., Inc., Baltimore, Md.

\*WHEELER CONDENSER & ENGINEERING CO., Carteret, N. J...*p.* 127**—Evaporator**AMERICAN BRASS CO., Waterbury, Conn...  
...*p.* 401\*WHEELER CONDENSER & ENGINEERING CO., Carteret, N. J...*p.* 127**—Pneumatic Despatch**\*LAMSON CO., 100 Boylston St., Boston, Mass...*pp.* 346, 347

Standard Carrier Co., 112 E. 41st St., New York

Universal Tube Co., 142-152 W. Ohio St., Chicago, Ill.

**TUBING****—Alloy**AMERICAN BRASS CO., Waterbury, Conn...  
...*p.* 401

Ohio Seamless Tube Co., Shelby, O.

SANDUSKY FOUNDRY & MACHINE CO., Sandusky, O...*p.* 664\*WHEELER CONDENSER & ENGINEERING CO., Carteret, N. J...*p.* 127**—Aluminum**\*ALUMINUM CO. OF AMERICA, Pittsburgh, Pa...*p.* 400AMERICAN BRASS CO., Waterbury, Conn...  
...*p.* 401

Bridgeport Brass Co., Bridgeport, Conn.

Ivin's Tube Works, Ellwood, Oak Lane Station, Philadelphia, Pa.

Rome Hollow Wire &amp; Tube Co., Rome, N. Y.

**—Automobile**

Detroit Seamless Steel Tubes Co., 841 Jefferson Ave., West, Detroit, Mich.

**—Bakelite**\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa...*pp.* 128, 129**—Bent and Swaged**

American Tube Bending Co., New Haven, Conn.

**—Brass and Copper**AMERICAN BRASS CO., Waterbury, Conn...  
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Baltimore Tube Co., Inc., Baltimore, Md.

\*RICHARDSON-PHENIX CO., 126 Reservoir Ave., Milwaukee, Wis...*pp.* 206, 207, 208, 209**—Brass and Copper (Seamless)**AMERICAN BRASS CO., Waterbury, Conn...  
...*p.* 401

Baltimore Tube Co., Inc., Baltimore, Md.

Chase Rolling Mill Co., Waterbury, Conn.

Erie-Buffalo Tube Co., 1227 W. 18th St., Erie, Pa.

Hungerford Brass &amp; Copper Co., U. T., 80 Lafayette St., N. Y. C.

MacKenzie-Walton Co., Pawtucket, R. I.

Rome Hollow Wire &amp; Tube Co., Rome, N. Y.

Rutter &amp; Co., Arthur T., 256 Broadway, New York

SANDUSKY FOUNDRY & MACHINE CO., Sandusky, O...*p.* 664\*WHEELER CONDENSER & ENGINEERING CO., Carteret, N. J...*p.* 127**—Carburetor, Flexible Metal**AMERICAN METAL HOSE CO., Waterbury, Conn...*p.* 220**—Exhaust, Flexible Metal**AMERICAN METAL HOSE CO., Waterbury, Conn...*p.* 220**—Fibre**AMERICAN VULCANIZED FIBRE CO., Wilmington, Del...*p.* 403\*CONTINENTAL FIBRE CO., Newark, Del...  
...*p.* 404DIAMOND STATE FIBRE CO., Bridgeport, Pa...*p.* 405**—Hard Rubber**

Stokes Rubber Co., Jos., Trenton, N. J.

**—Lead**UNITED LEAD CO., 111 Broadway, New York...*p.* 402**—Metal, Flexible**

Almond Mfg. Co., T. R., Ashburnham, Mass.

AMERICAN METAL HOSE CO., Waterbury, Conn...*p.* 220

Penn. Flexible Metallic Tubing Co., N. E. Cor. Broad &amp; Race Sts., Philadelphia, Pa.

U. S. Flexible Metallic Tubing Co., 430 Boyd St., Los Angeles, Cal.

WHITE DENTAL MFG. CO., S. S., 5-7-9 Union Square, West, New York...*p.* 315**—Oil Well**MARK MFG. CO., P. O. Box G, Chicago, Ill...  
...*p.* 197MONONGAHELA TUBE CO., Pittsburgh, Pa...*p.* 78

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Cincinnati Rubber Mfg. Co., Cincinnati, Ohio  
GOODRICH CO., B. F., Akron, O...*pp. 221, 320*

Hamilton Rubber Mfg. Co., Trenton, N. J.

**—Steel**

MARK MFG. CO., P. O. Box G, Chicago, Ill...*p. 197*

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Phenix Tube Co., Brooklyn, N. Y.

\*RICHARDSON-PHENIX CO., 126 Reservoir Ave., Milwaukee, Wis...*pp. 206, 207, 208, 209*

**—Steel (Seamless)**

Blum & Co., Julius, 532-40 W 22nd St., New York

Detroit Seamless Steel Tube Co., 841 Jefferson Ave., West, Detroit, Mich.

Ivins' Tube Works, Ellwood, Oak Lane Station, Philadelphia, Pa.

Latshaw Steel & Metal Products Corp'n, Spring City, Pa.

National Tube Co. (Shelby), Frick Bldg., Pittsburgh, Pa.

Ohio Seamless Tube Co., Shelby, O.

Standard Seamless Tube Co., Ambridge, Pa.

WARD'S SONS CO., EDGAR T., Boston, Mass...*p. 409*

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**TUMBLING BARRELS**

Abbott Ball Co., Elmwood, Conn.

Baird Machine Co., Bridgeport, Conn.

Illinois Mfg. & Supply Co., Quincy, Ill.

**—Burnishing**

Globe Machine & Stamping Co. (Globe), 1254 W. 76th St., Cleveland, O.

Sly Mfg. Co., W. W., Cleveland, O.

**—Sand Blast**

American Foundry Equipment Co., 52 Vanderbilt Ave., New York

NEW HAVEN SAND BLAST CO., New Haven, Conn...*p. 651*

\*PANGBORN CORP'N, P. O. Box 859, Hagerstown, Md...*pp. 652, 653*

Tilghman-Brooksbank Sand Blast Co., 1126 S. Eleventh St., Philadelphia, Pa

**TURBINES****—Hydraulic**

\*ALLIS-CHALMERS MFG. CO., Milwaukee, Wis...*pp. 4, 5*

Christiana Machine Co., Christiana, Pa.

\*CRAMP & SONS SHIP & ENGINE BLDG. CO., WM., Richmond & Norris Sts., Philadelphia, Pa...*pp. 604, 605*

Davis Foundry & Machine Works, Rome, Ga.

Holyoke Machine Co., Holyoke, Mass.

\*HUNT MACHINE CO., RODNEY, Orange, Mass...*p. 603*

Hydraulic Turbine Corp'n, Camden, N. Y.

JOLLY, INC., J. & W., Holyoke, Mass...*p. 606*

\*LEFFEL & CO., JAMES, Springfield, O...*p. 607*

Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

PELTON WATER WHEEL CO., Harrison & 19th Sts., San Francisco, Cal...*p. 608*

PLATT IRON WORKS, Dayton, O...*p. 594*

\*POOLE ENGINEERING & MACHINE CO., Woodberry, Baltimore, Md...*pp. 274, 275*

Smith Co., S. Morgan, York, Pa.

Trump Mfg. Co., Springfield, O.

United Iron Works, Oakland, Cal.

WELLMAN-SEAEVER-MORGAN CO., Cleveland, O...*p. 384*

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\*ALLIS-CHALMERS MFG. CO., Milwaukee, Wis...*pp. 4, 5*

Carling Turbine Blower Co., 72 School St., Worcester, Mass.

**COPPUS ENGINEERING & EQUIPMENT**

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Dominion Bridge Co., Ltd., Montreal, Quebec

\*GENERAL ELECTRIC CO., Schenectady, N. Y...*pp. 16-25, inc.*

\*GREEN FUEL ECONOMIZER CO., 90 West St., New York...*p. 74*

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Midwest Engine Co., Indianapolis, Ind.

MOORE STEAM TURBINE CORP'N, Wellsville, N. Y...*p. 27*

Platt & Co., John, 97 Cedar St., New York

Power Turbo Blower Co., 347 Madison Ave., New York

Ridgway Dynamo & Engine Co., Ridgway, Pa.

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\*STURTEVANT CO., B. F., Hyde Park, Boston, Mass...*pp. 90, 91*

Terry Steam Turbine Co., Terry Sq., Hartford, Conn.

Turbine Equipment Co., 50 Church St., New York

Vulcan Iron Works, Inc., Jersey City, N. J.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa...*pp. 128, 129*

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Carling Turbine Blower Co., 72 School St., Worcester, Mass.

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INGERSOLL-RAND CO., 11 Broadway, New York...*pp. 572, 573*

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Power Turbo-Blower Co., 347 Madison Ave., New York

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Spencer Turbine Co., Hartford, Conn.

Terry Steam Turbine Co., Terry Sq., Hartford, Conn.

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\*DE LAVAL STEAM TURBINE CO., 580 Jackson Ave., Trenton, N. J...*p. 15*

\*GENERAL ELECTRIC CO., Schenectady, N. Y...*pp. 16-25, inc.*

INGERSOLL-RAND CO., 11 Broadway, New York...*pp. 572, 573*

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Spencer Turbine Co., Hartford, Conn.

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Power Turbo Blower Co., 347 Madison Ave., New York

Terry Steam Turbine Co., Terry Sq., Hartford, Conn.

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#### **TURNBUCKLES**

Merrill Bros., Mesepth, N. Y.

Michigan Bolt & Nut Works, Detroit, Mich.

NEWHALL CHAIN FORGE & IRON CO., 90 West St., New York... *p.* 388

#### **TURNABLES**

American Bridge Co., 30 Church St., New York

Canton Foundry & Machine Co., Canton, O.

\*LINK-BELT CO., Philadelphia, Pa... *p.* 341

#### **Overhead Track**

PHILADELPHIA TRAMRAIL CO., Front St. & Indiana Ave., Philadelphia, Pa... *p.* 375

#### **Portable**

McKierman-Terry Drill Co., 15 Park Row, New York

#### **TURRET HEADS (Bench Lathe)**

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#### **TURRET MACHINES**

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#### **TWIST DRILL MAKING MACHINERY**

Schweppe & Wilt Mfg. Co., Detroit, Mich.

#### **TWIST DRILLS**

(See Drills, Twist)

## **U**

#### **UNDERFEED STOKERS**

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#### **UNIONS**

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Bard Union Co., Inc., Norwich, Conn.

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Jefferson Union Co., Lexington, Mass.

McMann & Taylor Co. (Nantaco), 104-106 John St., New York

Rhode Island Fittings Co., Hills Grove, R. I.

Standard Union Co., 7 Water St., Boston, Mass.

Stoddard Union Co., Lockport, N. Y.

Williams, Inc., Franklin (Tuxedo), 39 Cortlandt St., New York

#### **Flange**

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Dart Mfg. Co., E. M., 136 Clifford St., Providence, R. I.

Eastwood Wire Mfg. Co., Belleville, N. J.

\*PITTSBURGH VALVE, FOUNDRY & CONST. CO., Pittsburgh, Pa... *pp.* 156, 157

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Rockwood Sprinkler Co. of Mass., 34-35 Harlow St., Worcester, Mass.

#### **Tuyere (Blast Furnace)**

Pittsburgh Brass Mfg. Co., Penn Ave., & 32nd St., Pittsburgh, Pa.

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##### **Air Compressor**

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\*JEFFREY MFG. CO., 904 North 4th St., Columbus, Ohio... *pp.* 344, 345

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##### **Portable (Vessel)**

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#### **UPSETTING MACHINES**

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NILES-BEMENT-POND CO., 111 Broadway, New York... *p.* 460

##### **Tire (With Punch and Shears)**

Luther Mfg. Co., Olean, N. Y.

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#### **VACUUM BREAKERS**

Consolidated Engine Stop Co., 350 W. 38th St., New York

Morton Vacuum Breaker Co., Hyde Park, Boston, Mass.

Wood, Robert, 15 Hawthorne St., Brooklyn, N. Y.

#### **VACUUM CLEANING MACHINERY**

American Radiator Co., 816-822 S. Michigan Ave., Chicago, Ill.

Monarch Vacuum Specialties Corp'n, 1161-1175 Broadway, New York

Spencer Turbine Co., Hartford, Conn.

#### **VACUUM DRYERS, HEATING SYSTEMS, PANS, PUMPS, TRAPS, ETC.**

(See Dryers, Heating Systems, Pans, Pumps, Traps, etc., Vacuum)

#### **VACUUM DRYING APPARATUS**

Buffalo Foundry & Machine Co., E. Perry St. & Fillmore Ave., Buffalo, N. Y.

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SWENSON EVAPORATOR CO., 945 Monadnock Block, Chicago, Ill... *p.* 633

#### **VACUUM HEADS (For Ingot Molds)**

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#### **VALVE BALLS**

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Hartford Engine Works, 223 State St., Hartford, Conn.

**VALVE CHESTS, UNIVERSAL (Locomotives)**

Economy Devices Corp'n, 30 Church St., New York

**VALVE CUPS**

Schenck Mfg. & Supply Co., Parkers Landing, Pa.

**VALVE INSERTING MACHINES (Water)**

Smith Mfg. Co., A. F., East Orange, N. J.

**VALVE RESEATING MACHINES**

Leavitt Machine Co., Orange, Mass.

**VALVE STEMS (Gas Engine)**

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Chemical Pump & Valve Co., 237 Gifford St., Perth Amboy, N. J.

Cleveland Brass Mfg. Co., 4606 Hamilton Ave., Cleveland, O.

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Eastwood Wire Mfg. Co., Belleville, N. J.

Everlasting Valve Co., 2 Rector St., New York

\*HOMESTEAD VALVE MFG. CO., P. O. Box 1754, Pittsburgh Pa... *p. 145*

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Lippold Valve Co., Erie, Pa.

Monarch Mfg. Works, 3130 Emery St., Philadelphia, Pa.

Murray Pump & Valve Mfg. Co., New Lexington, O.

Nassau Valve & Pump Co., Inc., Rockville Center, L. I., N. Y.

\*NELSON VALVE CO., Chestnut Hill, Philadelphia, Pa... *pp. 154, 155*

\*SCHUTTE & KOERTING CO., 1184 Thompson St., Philadelphia, Pa... *pp. 160, 161*

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Brunner Mfg. Co., Utica, N. Y.

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\*CROSBY STEAM GAGE & VALVE CO., 40 Central St., Boston, Mass... *p. 244*

Foster Engineering Co., Newark, N. J.

Hall Steam Pump Co., Pittsburgh, Pa.

Hoffman Specialty Co., 512 Fifth Ave., New York

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Marsh & Co., James P., 118 S. Clinton St., Chicago, Ill.

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National Steam Specialty Co., 12 S. Clinton St., Chicago, Ill.

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Milwaukee Valve Co., 139 Burrell St., Milwaukee, Wis.

Ohio Injector Co., S. Main St., Wadsworth, O.

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Cash Co., A. W., Decatur, Ill.

Chaplin-Fulton Mfg. Co., 28 Penn Ave., Pittsburgh, Pa.

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- Star Brass Mfg. Co., 53 Oliver St., Boston, Mass.
- Triumph Valve Mfg. Co., P. O. Box 327, Mansfield, O.
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 Refrigerating Specialties Co., 9 S. Clinton St., Chicago, Ill.
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Open Coil Heater & Purifier Co., Indianapolis, Ind.  
Peerless Engineering Co., 1253 1st Nat'l Bank  
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Positive Differential System Co., 9 Murray St.,  
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Merritt Mfg. Co., Lockport, N. Y.

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Dicks, Slosson Co., Inc., 302 Broadway, New  
York  
Dixie Mfg. Co., Inc., Russell St. & B. & O. R. R.,  
Baltimore, Md.  
Hlg Electric Ventilating Co., 154 Whiting St.,  
Chicago, Ill.  
Kernchen Co., McCormick Bldg., Chicago, Ill.  
C. J. Merrill, Inc., 85 Kennebec St., Portland, Me.  
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Aspronet Co., 1st Nat'l Bank Bldg., Pittsburgh,  
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Burt Mfg. Co., Akron, O.  
Kernchen Co., McCormick Bldg., Chicago, Ill.  
Nightingale & Childs Co., 205 Congress St., Bos-  
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Van Noorden Co., E., 102 Magazine St., Rox-  
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**VIBRATORS, PNEUMATIC**

U. S. Molding Machine Co., 968 E. 69th Place,  
Cleveland, O.

Tesmer Machine & Tool Co., 285-91 Rivard St.,  
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Fulton Machine & Vise Co., Lowville, N. Y.  
Hartford Special Machinery Co., Hartford, Conn.  
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Rock Island Mfg. Co., Rock Island, Ill.  
Spafford Tool Works (Supreme), 10 Hoadley  
Pl., Hartford, Conn.

Western Tool & Mfg. Co., Springfield, O.

—**Divided Machine**

Schuchardt & Schutte, 90 West St., New York  
Zernickow, O. (O 2), 15 Park Row, New York

—**Drill Press**

Bicknell Mfg. & Supply Co., Janesville, Wis.  
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Nestor Mfg. Co., Inc., 40 W. 13th St., New York  
Rearwin, W. D., 341 Mill Ave., Grand Rapids,  
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—**Machine Tool**

Bridgeport Engineering Co., Bridgeport, Conn.  
Brown Engineering Co., Reading, Pa.  
Edlund Machinery Co., Inc., Cortland, N. Y.  
Ketchum Tool Equipment Co. (Sanford), 1st  
Bridgeport Nat'l Bank Bldg., Bridgeport, Conn.  
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Universal Equalizer Co., 132 Opera Place, Cin-  
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Yost Mfg. Co., Meadville, Pa.

—**Pattern Makers'**

Upton & Gilman Machine Co., 587 Middlesex  
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Emmert Mfg. Co., Waynesboro, Pa.  
Prentiss Vise Co., 110 Lafayette St., New York

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Bosworth Ard. Machine & Foundry Co., Inc., Anniston, Ala.  
 Gasket Supply Co., 1718 Ludlow St., Philadelphia, Pa.  
 Wrought Washer Mfg. Co., Milwaukee, Wis.

**—Copper**

Guillott Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

**—Felt**

Booth Felt Co., Inc., 440-450 14th St., Brooklyn, N. Y.

**—Lead**

Guillott Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

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**WATCHMAN'S RECORDERS**

Hardinge Bros., Inc., 1770 Berteau Ave., Chicago, Ill.  
 Newman Clock Co., 178 Fulton St., New York  
 Simplex Time Recorder Co. (Simplex), Gardner, Mass.

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 Reliance Gauge Column Co. (Reliance), 5902 Carnegie Ave., Cleveland, O.  
 Roberts Steam Specialty Co., 5318 St. Clair Ave., Cleveland, O.  
 Steigert Co., L., N. E. Cor. Elder & Sogan Sts., Cincinnati, O.  
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Cooling Tower Co., 15 John St., New York

**WATER PROOFING MATERIALS**

Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa.

Barrett Co., 17 Battery Pl., New York

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Master Builders Co., 806 Union Bldg., Cleveland, O.

Quinlan Co., Warner, 79 Wall St., New York  
Sonneborn Sons, Inc., L., 262 Pearl St., New York

Toch Brothers, 320 5th Ave., New York

Trus-Con Laboratories, Cor. Camff &amp; G. T. A. G., Detroit, Mich.

**WATER PURIFYING PLANTS**

Chemo-Mechanical Water Improvement Co., Bulletin Bldg., Philadelphia, Pa.

Detroit Steam Appliance Co., 500 Union Trust Bldg., Detroit, Mich.

DODGE SALES & ENGINEERING CO.,  
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Hygeia Filter Co., 338 Denton Ave., Detroit, Mich.

Loomis-Manning Filter Distributing Co., 1421 S. 37th St., Philadelphia, Pa.

Michigan Engineering Co., Union Trust Bldg., Detroit, Mich.

New York Continental Jewell Filtration Co., 15 Broad St., New York

Power Plant Specialty Co. (Vater), 1306 Monadnock Block, Chicago, Ill.

Roberts Filter Mfg. Co., Darby, Pa.

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American Water Softener Co., 1011 Chestnut St., Philadelphia, Pa.

Borromite Co. of America, 105 W. Monroe St., Chicago, Ill.

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International Filter Co., 40 S. Dearborn St., Chicago, Ill.

Michigan Engineering Co., Union Trust Bldg., Detroit, Mich.

Moore Oil Co., York St. &amp; McLean Ave., Cincinnati, O.

Northern Water Softener Co., 2305 Fair Oakes Ave., Madison, Wis.

Permutit Co., 440 4th Ave., New York

Power Plant Specialty Co. (Vater) 1306 Monadnock Block, Chicago, Ill.

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Reisert Automatic Water Purifying Co., 23 E. 26th St., New York

Richmond Water Softener Co., Richmond, Ind.

Roberts Filter Mfg. Co., Darby, Pa.

\*SCIAFE & SONS CO., WM. B., Pittsburgh, Pa... *pp. 122, 675***WATER STERILIZERS**

Electric Water Sterilizer &amp; Ozone Co., Scottsdale, Pa.

R. U. V. Co., Inc., 165 Broadway, New York

**WATER SUPPLY SYSTEMS**

Dayton Pump &amp; Mfg. Co., 5th &amp; Northwood Sts., Dayton, O.

DEMING CO., Salem, O... *p. 584*

Douglas, W. &amp; B., Middletown, Conn.

Latta-Martin Pump Co., Hickory, N. C.

\*SCIAFE & SONS CO., WM. B., Pittsburgh, Pa... *pp. 122, 675*

Standard Pump &amp; Engine Co., Akron, O.

**WATER TUBE BOILERS**

(See Boilers, Water Tube)

**WATER WHEELS**

(See Turbines, Hydraulic)

**WATERWORKS SUPPLIES**

Bayard &amp; Co., M. L., Woodbine, N. J.

CLOW & SONS, JAMES B., 534-36 S. Franklin St., Chicago, Ill... *pp. 188, 189*DARLING VALVE & MFG. CO., Williamsport, Pa... *p. 142*

Pitometer Co., 25 Elm St., New York

\*UNITED STATES CAST IRON PIPE & FOUNDRY CO., Burlington, N. J... *p. 191*

Walker Mfg. Co., Fenton, Mich.

WOOD & CO., R. D., Philadelphia, Pa... *p. 616***WATT-HOUR METERS**

(See Meters, Watt-Hour)

**WATTMETERS**BRISTOL CO., Waterbury Conn... *p. 248*\*GENERAL ELECTRIC CO., Schenectady, N. Y... *pp. 16-25, inc.*

Hickok Electrical Instrument Co., 1051-4 Dupont Ave., Cleveland, O.

\*WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa... *pp. 128, 129*\*WESTON ELECTRICAL INSTRUMENT CO., 49 Weston Ave., Waverly Park, Newark, N. J... *p. 253***WEBBING**

Empire Mfg. Co., 97 Spring St., Lockport, N. Y.

Lambeth Rope Corp'n, New Bedford, Mass.

**WEIGHERS**

—Conveying

CONVEYING WEIGHER CO., 90 West St., New York... *p. 338*\*LINK-BELT CO., Philadelphia, Pa... *p. 341*

—Water

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 599*RICHARDSON SCALE CO., Passaic, N. J... *p. 228*SIMMONS CO., JOHN, 110 Center St., New York... *p. 229*WILCOX ENGINEERING CO., Saginaw, Mich... *pp. 230, 663*\*YARNALL-WARING CO. (Yarway), 7603-20 Queen St., Chestnut Hill, Philadelphia, Pa... *p. 163***WEIGHING MACHINES (Automatic)**AMERICAN KRON SCALE CO., 430 E. 53rd St., New York... *p. 227*AUTOMATIC WEIGHING MACHINE CO., 134-140 Commerce St., Newark, N. J... *p. 648*

Computing Scale Co., Dayton, O.

Electric Weighing Co., 182 Thirteenth Ave., New York

Fairbanks &amp; Co., E. &amp; T., St. Johnsbury, Vt.

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 599*RICHARDSON SCALE CO., Passaic, N. J... *p. 228*SIMMONS CO., JOHN, 110 Center St., New York... *p. 229*

Streeter-Ames Weighing &amp; Recording Co., 4101-05 Ravenswood Ave., Chicago, Ill.

**WELDING**

—Chemical Reaction

Metal &amp; Thermit Corp'n, 120 Broadway, New York

—Electric

BOSSERT CORP'N, Utica, N. Y... *p. 413*CONNER & CO., INC., 2nd and Luzerne Sts., Philadelphia, Pa... *p. 668*

Lawrence &amp; Co., L., 290 Halsey St., Newark, N. J.

Metals Welding Co., 4400 Perkins Ave., Cleveland, O.

Pipe Coiling, Bending & Welding Co., Pittsburgh, Pa.  
**QUASI ARC WELDTRODE CO., INC.**, 2897 Atlantic Ave., Brooklyn, N. Y...*p. 566*  
 Rochester Welding Works, 349 Orchard St., Rochester, N. Y.  
 Standard Parts Co., Edgewater Park, Cleveland, O.  
 Standard Screw Products Co., Bellevue & Warren Ave., Detroit, Mich.  
 Thomson Electric Welding & Thomas Spot Welder Co., Lynn, Mass.  
 Universal Electric Welding Co., 67-69 Sixth St., Long Island City, N. Y.  
**WILLIAMS & CO., J. H.**, 70 Richards St., Brooklyn, N. Y...*p. 530*  
 —**Hammer Forge**  
 Kellogg Co., M. W., 90 West St., New York  
 —**Oxy-Acetylene**  
 Metals Welding Co., 4400 Perkins Ave., Cleveland, O.  
 Weldex Co., Richmond, Ind.  
 —**Spot**  
**BOSSERT CORP'N**, Utica, N. Y...*p. 413*  
**\*PITTSBURGH VALVE, FOUNDRY & CONST. CO.**, Pittsburgh, Pa...*pp. 156, 157*  
 Thomson Electric Welding & Thomson Spot Welder Co., Lynn, Mass.  
 Universal Electric Welding Co., 67-69 Sixth St., Long Island City, N. Y.  
 Winfield Electric Welding Machine Co., 10-16 Atlantic St., Warren, O.  
**WELDING AND BRAZING**  
 American Tube Bending Co., New Haven, Conn.  
**WELDING AND CUTTING APPARATUS (Oxy-Acetylene, etc.)**  
 Air Reduction Co., Inc., 120 Broadway, New York  
 Bastian-Blessing Co., W. Austin Ave. at La Salle St., Chicago, Ill.  
 Burdett Mfg. Co., 309 St. Johns Court, Chicago, Ill.  
 Cave Welding & Mfg. Co., 32 Liberty St., Springfield, Mass.  
 Cox Brass Mfg. Co., Albany, N. Y.  
 Davis-Bournonville Co., Jersey City, N. J.  
 Dyer Co., G. H., 155 Brookline St., Cambridge, Mass.  
 Economy Welding Machine Co., S. W. Blvd. & Central, Kansas City, Mo.  
 General Welding & Equipment Co., 107 Mass. Ave., Boston, Mass.  
 Henderson-Willis Welding & Cutting Co., 2305-07-09 N. 11th St., St. Louis, Mo.  
 Imperial Brass Mfg. Co. (Imperial), 1200 W. Harrison St., Chicago, Ill.  
**\*INTERNATIONAL OXYGEN CO.**, 796 Frelinghuysen Ave., Newark, N. J...*p. 567*  
**K-G WELDING & CUTTING CO., INC.**, 556 W. 34th St., New York...*p. 564*  
 Messer & Co., 113 Eleventh St., Brooklyn, N. Y.  
 Metals Welding Co., 4400 Perkins Ave., Cleveland, O.  
**MILBURN CO., ALEXANDER**, 1420-26 W. Baltimore St., Baltimore, Md...*p. 565*  
 Modern Engineering Co., 23rd & Walnut Sts., St. Louis, Mo.  
 Oxy-Carbi Co., New Haven, Conn.  
 Safety Car Heating & Lighting Co., 2 Rector St., New York  
 Thermalene Co., Chicago Heights, Ill.  
 Waterhouse Welding Co., 2 Pelham St., Boston, Mass.  
**WELDING AND CUTTING WORK**  
 Acetylene Welding Co., 241-245 E. 136th St., New York  
 Cave Welding & Mfg. Co., 32 Liberty St., Springfield, Mass.  
 Economy Welding Machine Co., S. W. Blvd. & Central, Kansas City, Mo.  
**\*INTERNATIONAL OXYGEN CO.**, 796 Frelinghuysen Ave., Newark, N. J...*p. 567*  
**K-G WELDING & CUTTING CO., INC.**, 556 W. 34th St., New York...*p. 564*  
 Linde Air Products Co., 30 E. 42nd St., New York

Metal & Thermit Corp'n, 120 Broadway, New York  
 The Metals Welding Co., 4400 Perkins Ave., Cleveland, O.  
 Rochester Welding Works, 349 Orchard St., Rochester, N. Y.  
**WHITNEY-MACDONALD CO.**, Tioga & Memphis Sts., Philadelphia, Pa...*p. 137*  
 Worcester Pressed Steel Co., Worcester, Mass...*p. 414*  
**WELDING MACHINES, ELECTRIC**  
 C & C Electric & Mfg. Co., Garwood, N. J.  
 Detroit Electric Welder Co., 710 E. Kalamazoo St., Lansing, Mich.  
**ELECTRIC ARC CUTTING & WELDING CO.**, 222 Halsey St., Newark, N. J...*p. 563*  
 Eveland Electric Riveter Co., West End Trust Bldg., Philadelphia, Pa.  
 Federal Machine & Welder Co., Dana Ave., Warren, O.  
 Taylor Welder Co., Warren, O.  
 Thomson Electric Welding & Thomson Spot Welder Co., Lynn, Mass.  
 Universal Electric Welding Co., 67-69 Sixth St., Long Island City, N. Y.  
**\*WESTINGHOUSE ELECTRIC & MFG. CO.**, East Pittsburgh, Pa...*pp. 128, 129*  
 Winfield Electric Welding Machine Co., 10-16 Atlantic St., Warren, O.  
 —**Arc Method**  
**\*GENERAL ELECTRIC CO.**, Schenectady, N. Y...*pp. 16-25, inc.*  
 Lincoln Electric Co., Kelly Ave. & 38th St., Cleveland, O.  
**QUASI ARC WELDTRODE CO., INC.**, 2897 Atlantic Ave., Brooklyn, N. Y...*p. 566*  
 U. S. Light & Heat Corp'n (USL), Niagara Falls, N. Y.  
 Wilson Welder & Metals Co., Inc., 2 Rector St., New York  
**WELDING SUPPLIES**  
 Henderson-Willis Welding & Cutting Co., 2305-07-09 N. 11th St., St. Louis, Mo.  
**\*INTERNATIONAL OXYGEN CO.**, 796 Frelinghuysen Ave., Newark, N. J...*p. 567*  
**K-G WELDING & CUTTING CO., INC.**, 556 W. 34th St., New York...*p. 564*  
 Modern Engineering Co., 23rd & Walnut Sts., St. Louis, Mo.  
 Thermalene Co., Chicago Heights, Ill.  
**QUASI ARC WELDTRODE CO., INC.**, 2897 Atlantic Ave., Brooklyn, N. Y...*p. 566*  
**WELL-DRILLING MACHINERY**  
 Keystone Driller Co., Beaver Falls, Pa.  
**\*NATIONAL SUPPLY COS.**, Toledo, O...*p. 661*  
**WELL SUPPLIES**  
**MARK MFG. CO.**, P. O. Box G, Chicago, Ill...*p. 197*  
**WHEATSTONE BRIDGES**  
 Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.  
 Thompson-Levering Co., 325 Arch St., Philadelphia, Pa.  
**WHEELS**  
 —**Car**  
 American Car & Foundry Co., 165 Broadway, New York  
**BASS FOUNDRY & MACHINE CO.**, Fort Wayne, Ind...*p. 39*  
 Engine & Machinery Co., Marion Ave. & Navarre Rd., S. W. Canton, O.  
**FAIRBANKS, MORSE & CO.**, 920 Wabash Ave., Chicago, Ill...*p. 599*  
**\*FULLER-LEHIGH CO.**, Fullerton, Pa...*p. 107*  
**\*LINK-BELT CO.**, Philadelphia, Pa...*p. 341*  
 Lobdell Car Wheel Co., P. O. Box 965, Wilmington, Del.  
 Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill.  
 Railway Steel Spring Co., 30 Church St., New York  
 Sanford-Day Iron Works, Knoxville, Tenn.

**WHEELS (Continued)****—Iron and Rubber**

Divine Bros. Co., Utica, N. Y.

**—Mine Car**

American Car &amp; Foundry Co., 165 Broadway, New York

AMERICAN PULLEY CO., 4200 Wissahickon Ave., Philadelphia, Pa... *p. 279*

Blakeslee Mfg. Co., Du Quoin, Ill.

Brownsville Foundry &amp; Machine Co., South Brownsville, Pa.

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 599*\*FULLER-LEHIGH CO., Fullerton, Pa... *p. 107*

Lobdell Car Wheel Co., P. O. Box 965, Wilmington, Del.

**—Pressed Steel**

Detroit Pressed Steel Co., Detroit, Mich.

FAIRBANKS, MORSE & CO., 920 Wabash Ave., Chicago, Ill... *p. 599***—Roller Bearing**

Blakeslee Mfg. Co., Du Quoin, Ill.

Hockensmith Wheel &amp; Mine Car Co., Penn Station, Pa.

**—Steel (Motor Truck)**

Clark Equipment Co., 1415 Railway Exchange, Buchanan, Mich.

Indestructible Wheel Co., Lebanon, Ind.

Massillon Steel Casting Co., Massillon, O.

**—Steel, Rolled**

Edgewater Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.

Standard Steel Works Co., Morris Bldg., Philadelphia, Pa.

**—Tractor**

Whitehead &amp; Kales Iron Works, Beecher Ave. &amp; M. C. R. R., Detroit, Mich.

**—Trolley**\*FULLER-LEHIGH CO., Fullerton, Pa... *p. 107***—Wire (Automobile)**STANDARD ROLLER BEARING CO., Philadelphia, Pa... *pp. 312, 313***WHISTLES, STEAM**AMERICAN STEAM GAUGE & VALVE MFG. CO., Boston, Mass... *pp. 164, 165*ASHTON VALVE CO., 161 First St., Cambridge, Boston, Mass... *p. 243*\*BROWN CO., A. & F., 79 Barclay St., New York... *p. 261*\*CRANE CO., 836 S. Michigan Ave., Chicago, Ill... *pp. 138, 139, 140, 141*\*CROSBY STEAM GAGE & VALVE CO., 40 Central St., Boston, Mass... *p. 244*LONERGAN CO., J. E., 211-215 Race St., Philadelphia, Pa... *pp. 153, 245*

Union Water Meter Co., 33 Hermon St., Worcester, Mass.

**WHITE LEAD**

National Lead Co. (Dutch Boy), 111 Broadway, New York

**WHITE METALS**

(See Metals, White)

**WINCHES****—Contractor's**AMERICAN HOIST & DERRICK CO., St. Paul, Minn... *p. 377***—Electric**BOX & CO., INC., ALFRED, Philadelphia, Pa... *pp. 364, 365*

Gilbert-Grant Co., 141 Broadway, New York

**—Hand Power**

Horton Co., Inc., John T., 157th St. &amp; 8th Ave., New York

**—Ship**AMERICAN HOIST & DERRICK CO., St. Paul, Minn... *p. 377*

Dake Engine Co., Grand Haven, Mich.

Eckliff Circulator Co. (J. H.), 46 Shelby St., Detroit, Mich.

FLORY MFG. CO., S., Bangor, Pa... *p. 379*

Gray Aldrich Co., Inc., 33 Commercial Wharf, Boston, Mass.

\*LIDGERWOOD MFG. CO., 96 Liberty St., New York... *p. 381*

Round &amp; Son, D., Cleveland, O.

**—Truck**

Bay City Foundry &amp; Machine Co. (Bay City Winch), 26th &amp; Water Sts., Bay City, Mich.

Erie Hoist Co., 2101 Holland St., Erie, Pa.

**WINDING MACHINES**

The Kruger &amp; Blind Co., 513 Master St., Philadelphia, Pa.

Universal Winding Co., Boston, Mass.

**WIRE****—All Metals (in Fine Gauges)**AMERICAN BRASS CO., Waterbury, Conn. *p. 401*

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J... *p. 386*WRIGHT WIRE CO., Worcester, Mass... *p. 387***—Aluminum**\*ALUMINUM CO. OF AMERICA, Pittsburgh, Pa... *p. 400***—Annealed**\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J... *p. 386*WRIGHT WIRE CO., Worcester, Mass... *p. 387***—Brass and Copper**AMERICAN BRASS CO., Waterbury, Conn. *p. 401*\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J... *p. 386*

Seymour Mfg. Co., Seymour, Conn.

WRIGHT WIRE CO., Worcester, Mass... *p. 387***—Copper, Rubber Insulated**

Hazard Mfg. Co., Wilkes-Barre, Pa.

**—Flat**

Prentiss &amp; Co., Geo. W., Holyoke, Mass.

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J... *p. 386*WRIGHT WIRE CO., Worcester, Mass... *p. 387***—Iron and Steel**

Atlantic Steel Co., Atlanta, Ga.

Pittsburgh Steel Co., Union Arcade Bldg., Pittsburgh, Pa.

Prentiss &amp; Co., Geo. W., Holyoke, Mass.

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J... *p. 386*

Spencer Wire Co., Worcester, Mass.

United States Steel Products Co., 4th Ave. &amp; Connecticut St., Seattle, Wash.

WHEELLOCK, LOVEJOY & CO., 128 Sidney St., Cambridge, Mass... *p. 410*WRIGHT WIRE CO., Worcester, Mass... *p. 387***—Lead**UNITED LEAD CO., 111 Broadway, New York... *p. 402***—Monel Metal**

Supplee-Biddle Hardware Co., 512 Commerce St., Philadelphia, Pa.

**—Nickel**

Haring, Ellsworth, 114 Liberty St., New York

**—Piano**WARD'S SONS CO., EDGAR T., Boston, Mass... *p. 409***—Screen**

New Jersey Wire Cloth Co., Trenton, N. J.

**—Spring**

Kidd Drawn Steel Co., Aliquippa, Pa.

**—Tool Steel**WARD'S SONS CO., EDGAR T., Boston, Mass... *p. 409***—Welding**

Apex Steel Corp'n, 50 Church St., New York

Central Steel &amp; Wire Co., 119 N. Peoria St., Chicago, Ill.



Federal Tool & Alloy Steel Corp'n, Woolworth Bldg., N. Y. C.  
Philadelphia Steel & Iron Co., 1008 Commercial Trust Bldg., Philadelphia, Pa.  
Prentiss & Co., Geo. W., Holyoke, Mass.

**WIRE AND CABLES, ELECTRICAL**

\*ALUMINUM CO. OF AMERICA, Pittsburgh, Pa... *p. 400*

AMERICAN BRASS CO., Waterbury, Conn. ... *p. 401*

American Steel & Wire Co., 72 W. Adams St., Chicago, Ill.

D & W FUSE CO., Providence, R. I. ... *p. 520*

\*GENERAL ELECTRIC CO., Schenectady, N. Y. ... *pp. 16-25, inc.*

GOODRICH CO., B. F., Akron, O. ... *pp. 221, 320*

Hazard Mfg. Co., Wilkes-Barre, Pa.  
NEW ENGLAND BUTT CO., Providence, R. I. ... *p. 657*

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J. ... *p. 386*

United States Steel Products Co., 4th Ave. & Connecticut St., Seattle, Wash.

Western Electric Co., Inc., 195 Broadway, New York

**WIRE BUNCHING MACHINES**

AMERICAN INSULATING MACHINERY CO., Fairhill & Huntington Sts., Philadelphia, Pa. ... *p. 656*

**WIRE CARDS**

Rogers Wire Works, Inc., 291 Broadway, New York

**WIRE CLOTH**

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**WIRE, COILING MACHINES**

SLEEPER & HARTLEY, INC., Worcester, Mass. ... *pp. 646, 647*

**WIRE, DRAWING MACHINERY**

Aetna Foundry & Machine Co., Warren, O.  
AMERICAN INSULATING MACHINERY CO., Fairhill & Huntington Sts., Philadelphia, Pa. ... *p. 656*

Morgan Construction Co., Worcester, Mass.  
NEW ENGLAND WIRE MACHINERY CO., New Haven, Conn. ... *p. 658*

Richard Mfg. Co., Bloomsburg, Pa.  
Standard Machinery Co., Auburn, R. I.

TORRINGTON MFG. CO., Torrington, Conn. ... *p. 645*

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

**WIRE ENAMELING MACHINERY**

AMERICAN INSULATING MACHINERY CO., Fairhill & Huntington Sts., Philadelphia, Pa. ... *p. 656*

**WIRE FORMING MACHINES**

Atlas Machine Co., 140 Manhan St., Waterbury, Conn.

Baird Machine Co., Bridgeport, Conn.

BLAKE & JOHNSON CO., Waterbury, Conn. ... *p. 644*

Cobden Machine Works, Cobden, Ill.

Hinsman Machine & Tool Co., Elm St., Westfield, Mass.

Manville Machine Co., E. J., Waterbury, Conn.

Nilson Machine Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

SLEEPER & HARTLEY, INC., Worcester, Mass. ... *pp. 646, 647*

Smurr & Kamen Co., 328 No. Albany Ave., Chicago, Ill.

TOLEDO MACHINE & TOOL CO., Toledo, O. ... *pp. 422, 423*

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(See Insulating Machinery)

**WIRE MEASURING MACHINERY**

AMERICAN INSULATING MACHINERY CO., Fairhill & Huntington Sts., Philadelphia, Pa. ... *p. 656*

**WIRE MECHANISM (Lever Control)**

\*GWILLIAM CO. (Bowden), 253 W. 58th St., New York. ... *pp. 316, 317*

**WIRE MILL MACHINERY**

Brown Engine Co., Fitchburg, Mass.  
TORRINGTON MFG. CO., Torrington, Conn. ... *p. 645*

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

**WIRE NAIL MANUFACTURING MACHINERY**

National Machinery Co., Tiffin, O.

Perkins Co., Henry, Bridgewater, Mass.

SLEEPER & HARTLEY, INC., Worcester, Mass. ... *pp. 646, 647*

**WIRE RESPOOLING MACHINES**

AMERICAN INSULATING MACHINERY CO., Fairhill & Huntington Sts., Philadelphia, Pa. ... *p. 656*

**WIRE ROPE**

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**WIRE ROPE FASTENINGS**

AMERICAN HOIST & DERRICK CO. (Crosby), St. Paul, Minn. ... *p. 377*

Broderick & Bascom Rope Co., 805 N. Main St., St. Louis, Mo.

\*CLYDE IRON WORKS, 29th Ave., W. & Michigan St., Duluth, Minn. ... *p. 378*

Hazard Mfg. Co., Wilkes-Barre, Pa.

MACOMBER & WHYTE ROPE CO., Kenosha, Wis. ... *p. 385*

Moon Co., Inc., George C., Garwood, N. J.

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J. ... *p. 386*

Williamsport Wire Rope Co., Williamsport, Pa.

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y. ... *p. 530*

WRIGHT WIRE CO., Worcester, Mass. ... *p. 387*

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NEW ENGLAND BUTT CO., Providence, R. I. ... *p. 657*

NEW ENGLAND WIRE MACHINERY CO., New Haven, Conn. ... *p. 658*

**WIRE SPECIALTIES**

Cuyahoga Spring Co., Waterloo Road, Cleveland, O.

Gem Stopper Co., 2120 Nicholas St., Philadelphia, Pa.

Interstate Iron & Steel Co., 104 S. Michigan Ave., Chicago, Ill.

New Jersey Wire Cloth Co., Trenton, N. J.

\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J. ... *p. 386*

**WIRE STRAIGHTENING AND CUTTING MACHINERY**

Nilson Mach. Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

Shuster Co., F. B., New Haven, Conn.

SLEEPER & HARTLEY, INC., Worcester, Mass. ... *pp. 646, 647*

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OLSEN TESTING MACHINE CO., TINNIUS, 500 N. 12th St., Philadelphia, Pa. ... *p. 225*

RIEHL BROS. TESTING MACHINE CO., 1424 N. 9th St., Philadelphia, Pa. ... *p. 226*

**WIRE TINNING EQUIPMENT**

NEW ENGLAND WIRE MACHINERY CO., New Haven, Conn. ... *p. 658*

**WIRE WORK**

Howard & Morse, 45 Fulton St., New York

Morss & Whyte Co., Sidney & Pilgrim St., Cambridge, Mass.

New Jersey Wire Cloth Co., Trenton, N. J.

**WIRES, THREAD MEASURING**

TITAN AUTOMATIC TOOL CO., 25 W. Broadway, New York. ... *pp. 496, 497*

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BENJAMIN ELECTRIC MFG. CO., 395 Wash. Blvd., Chicago, Ill. ... *p. 684*

**WIRING DEVICES (Continued)**

Carleton-Mace Engine Corp'n, 38 Chardon St., Boston, Mass.  
Electric Co., 94 Allyn St., Hartford, Conn.  
\*GENERAL ELECTRIC CO., Schenectady, N. Y...*pp. 16-25, inc.*

**WOOD PRODUCTS**

American Balsa Corp'n, 50 E. 42nd St., New York  
Rutland Mfg. Co., Inc., Forest, West & Pine Sts., Rutland, Vt.

**WOOD SEASONING**

American Balsa Corp'n, 50 E. 42nd St., New York

**WOOD SCREW MACHINERY**

Cook Co., Asa S., Hartford, Conn.  
Townsend Mfg. Co., H. P., Hartford, Conn.

**WOOD WORKING MACHINERY**

Crescent Machine Co., Leetonia, O.  
Emmert Mfg. Co., Waynesboro, Pa.  
Enterprise Co., Columbiana, Ohio  
Falls Machine Co., Sheboygan Falls, Wis.  
Fay & Eagan Co., J. A., Cincinnati, O.  
Garland Co., M., Bay City, Mich.  
Gilman & Son, Springfield, Vermont  
Greenlee Bros. & Co., Rockford, Ill.  
\*JONES FOUNDRY & MACHINE CO., W. A., 4401-4451 West Roosevelt Road, Chicago, Ill...*pp. 268, 269, 270, 271*

NEW BRITAIN MACHINE CO., New Britain, Conn...*p. 449*

Newman Machine Co., Jackson St. & Sou. Ry., Greensboro, N. C.

Oliver Machinery Co., Grand Rapids, Mich.

Olney & Warrin, 406-412 Broome St., New York

Pettingell Machine Co., Amesbury, Mass.

Prybitt Machine Co., P., 512 W. 41st St., New York

Silver Mfg. Co., Salem, O.

Sinker Davis Co., Indianapolis, Ind.

Valley City Machine Works, 12-16 Campau Ave., Grand Rapids, Mich.

Wallace, J. D., 1401 W. Jackson Blvd., Chicago, Ill.

Whitney & Son, Baxter D., Inc., Winchendon, Mass.

Woods Machine Co., S. A., 27 Damrell St., South Boston, Mass.

**WOOLEN MANUFACTURING MACHINERY**  
Curtis & Marble Machine Co., 78 Cambridge St., Worcester, Mass.

DAVIS & FURBER MACHINE CO., North Andover, Mass...*p. 660*

Whitin Machine Works, Whitinsville, Mass.

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**WORK STANDS, PORTABLE**

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\*CLEVELAND WORM GEAR CO., Cleveland, O...*p. 264*

Hindley Gear Co., 1105 Frankford Ave., Philadelphia, Pa.

\*JONES FOUNDRY & MACHINE CO., W. A., 4401-4451 West Roosevelt Road, Chicago, Ill...*pp. 268, 269, 270, 271*

**WORSTED MANUFACTURING MACHINERY**

DAVIS & FURBER MACHINE CO., North Andover, Mass...*p. 660*

Saco-Lowell Shops, 77 Franklin St., Boston, Mass.

**WRENCHES**

Keystone Mfg. Co. (Westcott), 41-51 Chandler St., Buffalo, N. Y.

Kraeuter & Co., Inc., 585 18th Ave., Newark, N. J.

Lakeside Forge Co., Erie, Pa.  
Lamson & Sessions Co., Cleveland, O.  
Mossberg Co., Frank, Attleboro, Mass.  
Page-Storms Drop Forge Co., Chicopee, Mass.  
\*ROEBLING'S SONS CO., JOHN A., Trenton, N. J...*p. 386*

Trimont Mfg. Co. (Trimo), Roxbury, Boston, Mass.

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y...*p. 530*

WORCESTER PRESSED STEEL CO., Worcester, Mass...*p. 414*

**—Chain**

\*GREENE, TWEED & CO., 109 Duane St., New York...*p. 202*

KROESCHELL BROS. CO. (Ideal), 460 West Erie St., Chicago, Ill...*p. 58*

Robbins, Gamwell & Co., 68 West St., Pittsfield, Mass.

Trimont Mfg. Co. (Trimo), Roxbury, Boston, Mass.

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y...*p. 530*

**—Drop-Forged**

Armstrong Bros. Tool Co., 333 N. Francisco Ave., Chicago, Ill.

Lakeside Forge Co., Erie, Pa.

Whitman & Barnes Mfg. Co., 114 E. Buchtel Ave., Akron, O.

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y...*p. 530*

**—Pipe**

Moore Drop Forging Co. (Stillson), Springfield, Mass.

Trimont Mfg. Co. (Trimo), Roxbury, Boston, Mass.

Walworth Mfg. Co. (Stillson), First & O Sts., South Boston, Mass.

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y...*p. 530*

**—Ratchet**

\*GREENE, TWEED & CO., 109 Duane St., New York...*p. 202*

Keystone Mfg. Co. (Keystone), 41-51 Chandler St., Buffalo, N. Y.

Lowell Wrench Co., 54 Commercial St., Worcester, Mass.

**—Socket**

WILLIAMS & CO., J. H., 70 Richards St., Brooklyn, N. Y...*p. 530*

**—Tap**

Bay State Tap & Die Co., Mansfield, Mass.

Card Mfg. Co., S. W., Rumford Ave., Mansfield, Mass.

Carpenter Tap & Die Co., J. M., Pawtucket, R. I.

\*GREENFIELD TAP & DIE CORP'N, Greenfield, Mass...*pp. 500, 501*

PRATT & WHITNEY CO., 111 Broadway, New York...*p. 461*

**Y****YARN DRESSING MACHINERY**

Franklin Machine Co., 189 Charles St., Providence, R. I.

**Z****ZINC**

Hazel Atlas Glass Co., Wheeling, W. Va.

**—Electrolytic**

U. S. Smelting Refining & Mining Co., 120 Broadway, New York

















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